JANUARY, 1954

TOOLING and PRODUCTION

The Magazine of Manufacturing Management

T. P.

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DIAMOND GRIT TOOLS FOR THREAD DRESSING

INDUSTRIAL DIAMONDS

"Smash the Great Diamond, Before My Eyes!"

Vasilica was undoubtedly one of the most beautiful women in the whole world. Ali Pasha, Khedive of Egypt, was sure of it, and for such a treasure, what gift more fitting than this great diamond!

Treasured for centuries by Indian princes, it had been presented to Lord Piggott when he was Governor of Madras. When he died in 1770, it had been sold for $50,000 to a London pawnbroker who organized a lottery for the "Great Piggott Diamond" and saw it won by a poor clerk who quickly sold it and disappeared.

Recut to dazzling brilliance, it was presently offered to Ali Pasha who happily paid $150,000 for it and said, "Now, I have *two* great treasures—Vasilica and the great diamond."

But, Ali Pasha also had a deadly enemy, Raschid Pasha, who hated him and coveted his treasures and whose trained assassins awaited—and struck.

Realizing that his beloved treasures might now fall to his enemy, Ali gave one last command: "Smash the great diamond—before my eyes, and my dear wife, let her be strangled." But, while the slave was hammering the jewel to dust, Vasilica quietly slipped away and escaped.

Diamonds have played many such dramatic parts in the pageant of history, but today their greatest role is in the field of industry. And, for 43 years we have been serving industry by importing fine diamonds and making fine diamond tools. Our field engineers are at your service.

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Stamping output Up 400%
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Reaming Production Doubled
Bead Rolling Time Cut 50%
Milling Production Doubled
Production Increase In Surface Milling 300%
Hollow Milling and Drilling Production up 400%
40% Gain in Milling Production
Deep Hole Drilling Output Increased 350%
400% Production Gain in Drilling and Tapping
Output of Shell Molds Increased 815%
End Milling Time Cut 54%
Counterboring Production Jumped 133%

The key to every one of these production gains is a unique air cylinder whose basic cost was less than the operator's weekly pay check.

Every machining operation pictured here is being done on inexpensive, shop built, special purpose machines. Designed either by the companies' own engineers or by a Bellows Field Engineer, the machines were built from parts normally available in every tool room. But the heart of each machine — the thing that makes it tick — is one or more Bellows Air Motors — an air cylinder so different that it has sparked the creative imagination of tool engineers and production men in more than ten thousand plants.

This air cylinder, alone among all air cylinders made, combines the speed and flexibility of air, the sureness of electrical control, and, with the Bellows Hydro-Check control, the smoothness of hydraulics, all in one compact, packaged power unit.

Bellows Air Motors can be applied to hundreds of different standard machines to speed up feeding or ejection of parts; to feed tools faster, more accurately, safer; to permit relatively unskilled operators to turn out top quality work. They can be incorporated in special machines to perform any repetitive push, pull, lift or turn motion. The range of their usefulness is limited only by the ingenuity of the user.

813A

THIS NEW BOOKLET TELLS THE STORY

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Here in this fast reading 36 page bulletin is the dramatic story of Bellows Air Motors and other Bellows "Controlled-Air-Power" Devices. Packed full of design information, case history data, photographs and diagrams — information every man concerned with costs and production should have. It is free on request. Write — Dept. TP154, The Bellows Co., Akron 9, Ohio. In Canada, Bellows Pneumatic Devices of Canada, Ltd., Toronto.

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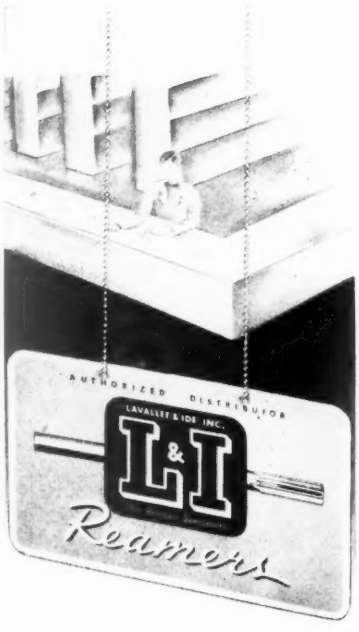

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TOOLING and PRODUCTION

The Magazine of Manufacturing Management

formerly
Tool-Die-Machine PROGRESS 1934-1941
TOOL & DIE JOURNAL 1941-51

Vol. XIX—No. 10 January, 1954

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They have the influence that enables them to adopt the ideas and the processes which TOOLING and PRODUCTION describes in every issue AND the authority to recommend, to specify and/or to buy everything that may be needed to reduce costs, increase production or improve quality. These men for whom, each month, our editors seek out or write TOOLING and PRODUCTION'S meticulously accurate stories of "Know-How" and "Tell-How" are T & P's exclusive Cycle of Buying Influence (CBI) in their plants.

Every copy is directed to these men by name, by title and by company address. Please see our CCA verification.

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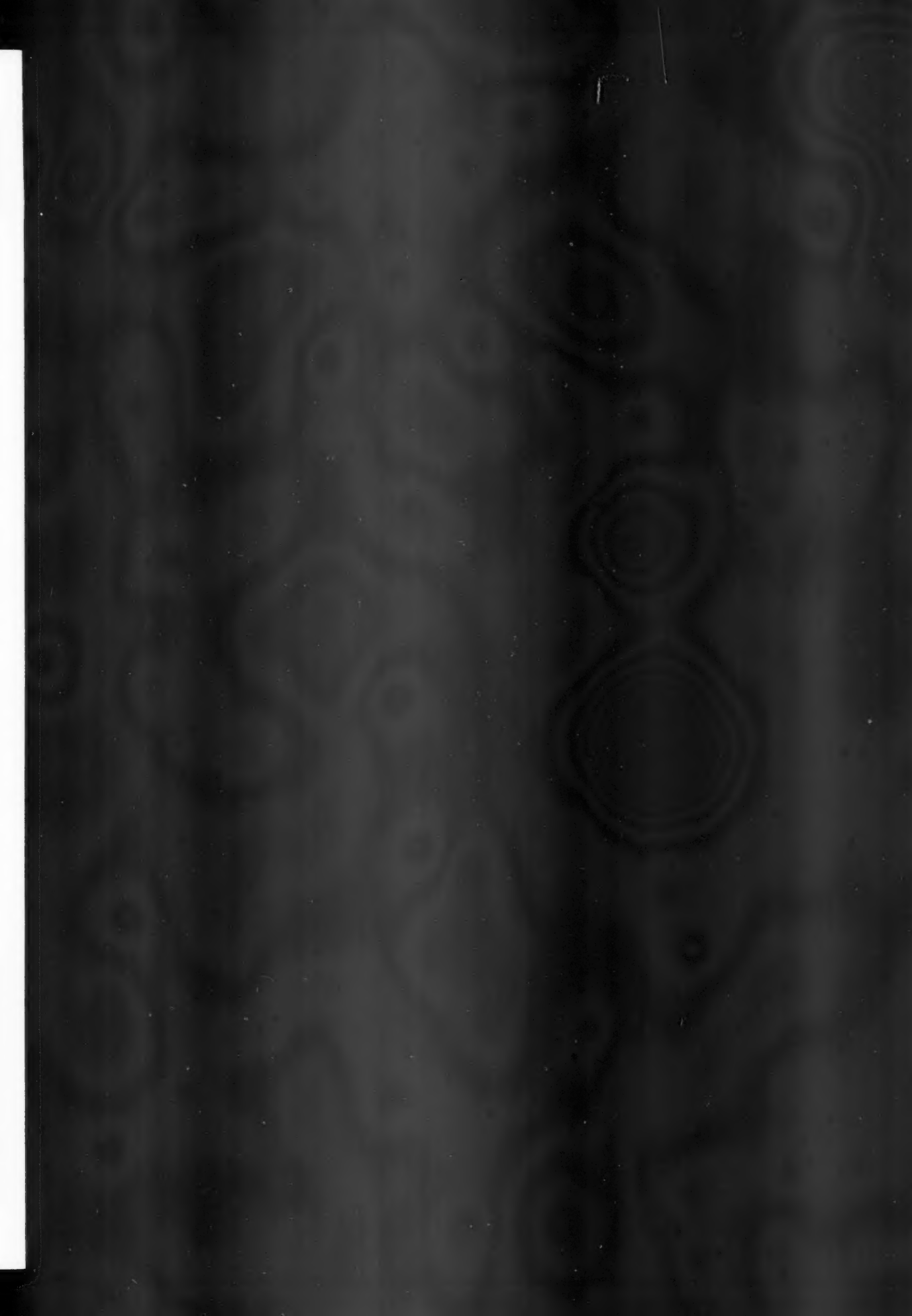
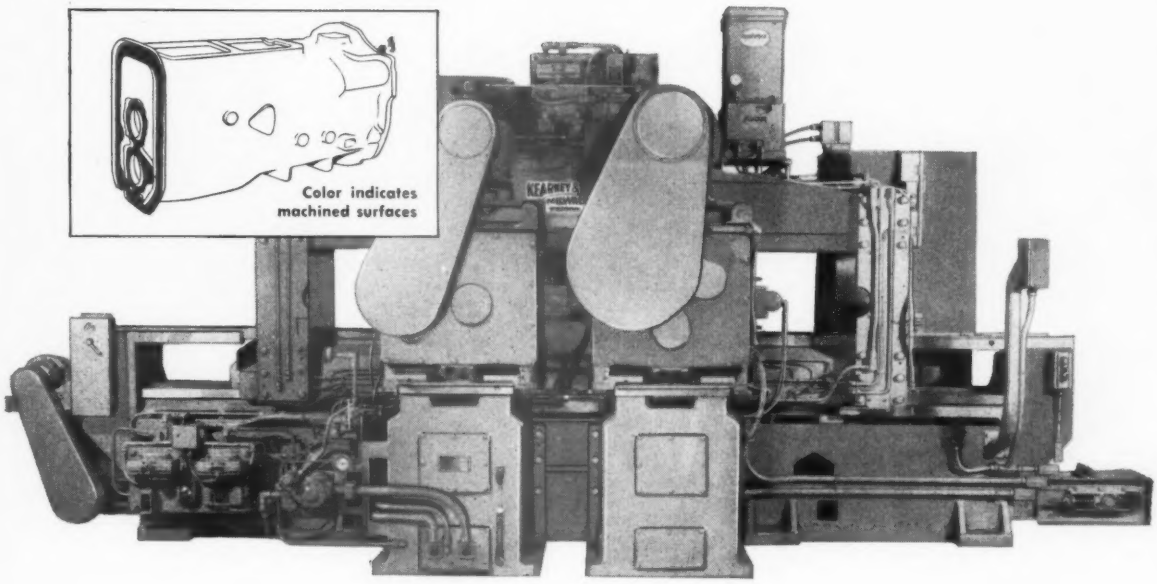


What a saving...

Builders of Precision and Production Machine Tools since 1898



For the customer... it combined four milling operations in one machine!

THIS special 6-spindle transfer type milling machine was designed and built to keep a tractor manufacturer's production line rolling at high speed. The machine now mills opposing end faces of tractor transmission cases both flat and parallel . . . to close tolerances (.002) . . . in only 94 seconds.

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CLAMPING MECHANISM . . . Large hollow workpiece is secured at each machining station by a tunnel-type hydraulic equalizing clamping fixture. This eliminates the distortion usually encountered when clamping this type of workpiece.

If you have problems that require special machinery—contact your Kearney & Trecker representative.

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For more details on this machine . . . ask for *Data Sheet No. 1002.* Free booklet, "Doorway to a proven method for solution of big and small metalworking problems" is also yours for the asking. *Write today to* SPECIAL MACHINERY DIVISION, KEARNEY & TRECKER CORP., 6784 West National Ave., Milwaukee 14, Wisconsin.

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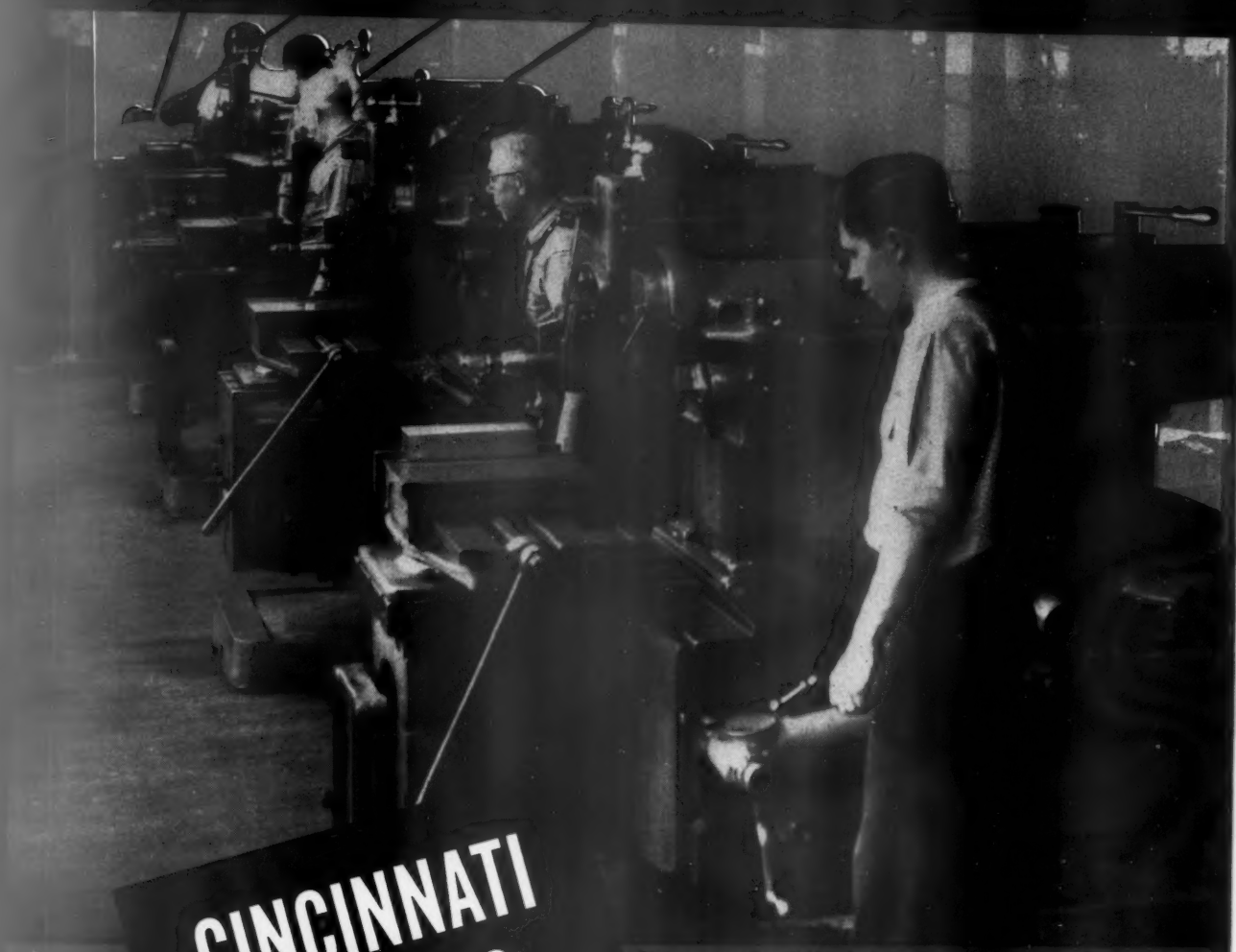

CINCINNATI SHAPERS

Photo courtesy Scovill Manufacturing Company, Waterbury, Connecticut.

...serve over 2,000,000 square feet of manufacturing facilities!

In this large plant of the Scovill Manufacturing Company this battery of Cincinnati Shapers economically does a wide range of precision work on many materials, including alloys of all metals from cast iron to high acid resistant tool steel.

Tools and new machinery are produced in this department, which also does maintenance work for the entire plant. The Cincinnati Electro Magnetic Clutch and Brake also contribute to speed here, where accuracy and versatile performance are necessary.

Write for New Cincinnati Shaper catalog N-6.

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which has specialized in horizontal boring machines

exclusively for over 50 years is . . .

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Only Lucas can make a Lucas . . . the boring machine which incorporates every important improvement.

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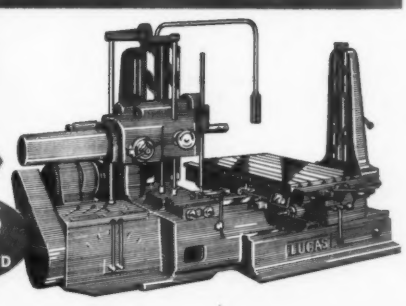
LUCAS MACHINE DIVISION; CLEVELAND 8, OHIO

. . . *Machines for Making Progress*
Lucas Horizontal Boring, Drilling and Milling Machines



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The Old Fashioned Plug Is Out Moded

In This Fast-Rolling MODERN Age

Users everywhere say:

DuBo* is the MODERN Plug Gage

*U.S. and Foreign Patents Granted

Gaging Surfaces are Portions of a Sphere

Operates by Tilting Handle

Whether handle will drop freely or not is the definite yes-or-no indication. No guesswork, no forcing, no fumbling!

COLOR Gives INSTANTANEOUS "FOOL-PROOF" INDICATION of GO and NO GO

For Quality Control

NO plug gage can equal DuBo

. . . IN ACCURACY

. . . IN EASE OF HANDLING

. . . IN SENSITIVITY

. . . IN LIGHT WEIGHT

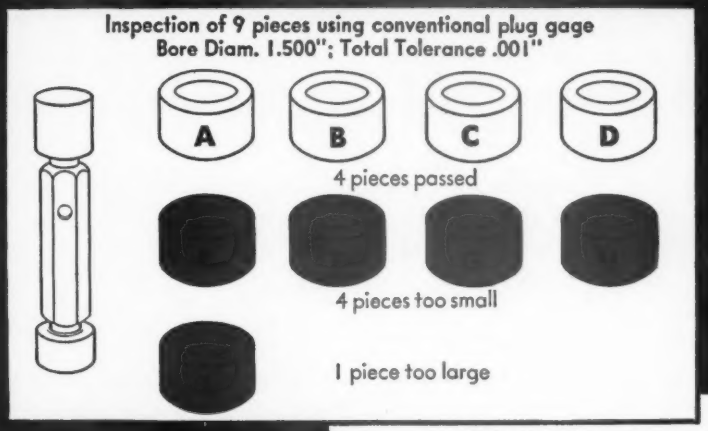
. . . IN LONG TERM SERVICE

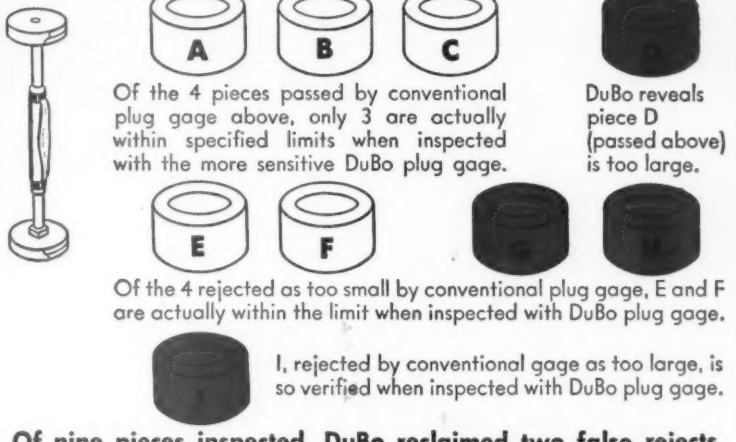
. . . IN COST SAVING AND PROFIT

Like so many items of modern design, DuBo Plug Gage *looks* different and *feels* different from the conventional plug gage. And even craftsmen of the old school, used to time-worn methods, quickly get the feel and take pride in the use of this *different* tool. *Added to that are the many actual cases where DuBo, after a fair trial, has replaced conventional plug gages.*

With exceptional ease of handling, DuBo gives a precise, definite and sensitive check of bore diameters, directly and with no element of confusion, even in unskilled hands. In the same application, DuBo reveals dimensional variations such as taper and out-of-round which ordinary plug gages cannot indicate.

An ABC Demonstration of DuBo* Plug Gage Superiority




RESULTS of same inspection using DuBo Plug Gage
A
B
C
Of the 4 pieces passed by conventional plug gage above, only 3 are actually within specified limits when inspected with the more sensitive DuBo plug gage.
DuBo reveals piece D (passed above) is too large.
E
F
Of the 4 rejected as too small by conventional plug gage, E and F are actually within the limit when inspected with DuBo plug gage.
I, rejected by conventional gage as too large, is so verified when inspected with DuBo plug gage.

Of nine pieces inspected, DuBo reclaimed two false rejects and rejected one piece that had been passed by ordinary plug gage inspection. Apply even a fraction of this ratio to a day's production in your own plant and you'll realize the advantage of using DuBo Plug Gages.

COST-SAVING FACTORS

DuBo Plug Gages outlast ordinary plugs many times. Extremely light in weight (in the larger sizes, 70% to 80% lighter than cylindrical plug gages of equivalent diameter) and requiring no jockeying into position for entry, DuBo effects economies in that important cost item, actual inspection time.

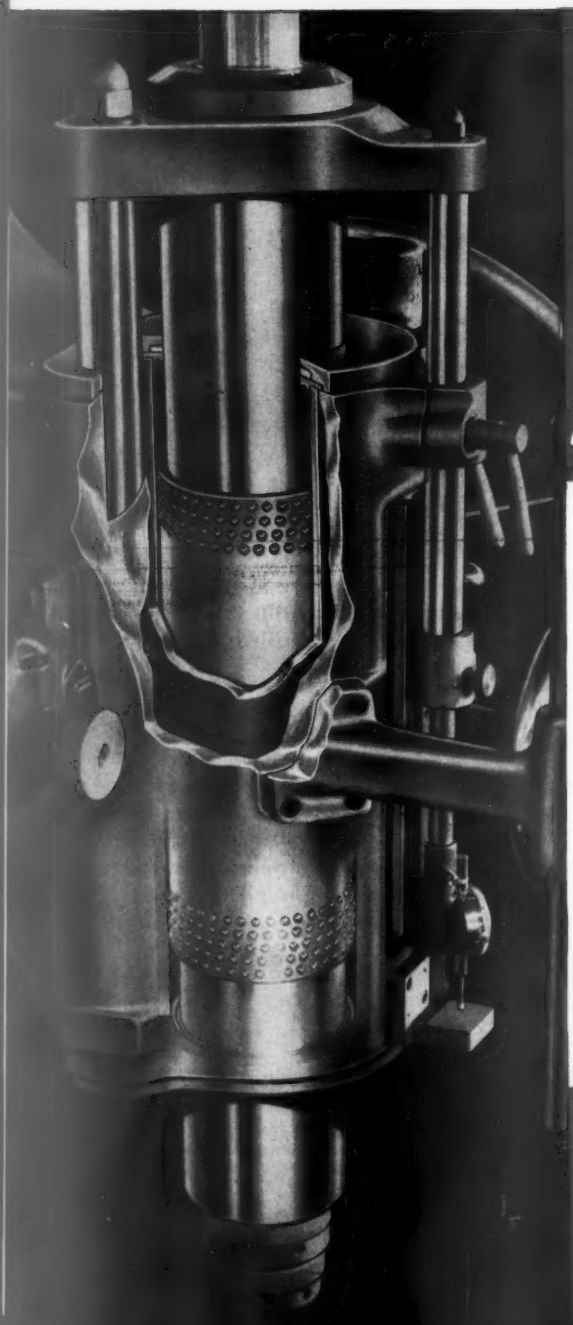
Use DuBo for Precision Plug Economy

When inspecting parts under quality control sampling procedure, it is important that those parts which may be close to either end of the tolerance range be properly classified. The definiteness and simplicity of DuBo gaging is a decided advantage in this type of inspection. Anyone who has tried to enter a cylindrical plug into a hole only .0001" larger than the gage, knows how difficult it is. For even skillful workers there is a point at which it becomes doubtful whether the bore is actually smaller than the gage size, or if it is larger and merely close. With DuBo Plug Gage, even an unskilled worker can easily enter the gage under any condition and quickly interpret bore conditions correctly. There need be no border-line cases of doubt regarding the proper classification of a bore. Use of the DuBo Plug Gage minimizes the cost of parts needlessly rejected and the expense accruing from those incorrectly passed.

TRY DuBo! Sense its craftsmanlike feel and balance. See how easily it enters, even in undersize bores . . . how gentle manipulation of the handle accurately reveals internal conditions. Use it on a *fussy* job and you'll KNOW why DuBo is replacing old time plug gages everywhere! Refer to Catalog C, Pages 18, 19, 20, 21. Or, write or phone for more detailed information.

ACCURACY to "TENTHS"

Indefinitely...



THANKS TO THE

Exclusive

PRECISION PRELOADED

Ball Roll Quill

Conventional jig borers — with the usual, plain slide bearing, quill construction — demand frequent, skilled maintenance for accurate operation. This trouble, down-time and expense is eliminated by the exclusive Pratt & Whitney Ball Roll Quill Spindle Head. Rigidity and the exceptionally high original accuracy are retained indefinitely; you can be sure of precision to "tenths" at all times

The Quill Bearing is a hardened steel liner, deep frozen and precision lapped in place. The quill . . . hardened precision ground and draw polished . . . "roll-feeds" on 360 specially selected, super-precision balls. Preloaded between the hardened quill and liner, they provide a total bearing pressure of over 8,000 pounds. Friction and wear are minimized and the up-down movement is highly sensitive for small-hole hand operation.

The P&W Ball Roll Quill spindle also adds far greater versatility. Ability to resist heavy lateral pressures without deflection or wear has made it practical to provide the table and carriage of the 4E Jig Borer with power feeds. This makes it possible to perform precision milling in addition to the usual boring operations.

DESIGNED, ENGINEERED and MANUFACTURED THROUGHOUT TO MEET TODAY'S DEMAND for FINER ACCURACY, GREATER VERSATILITY, BIGGER CAPACITY and INCREASED SPEED and EASE OF OPERATION

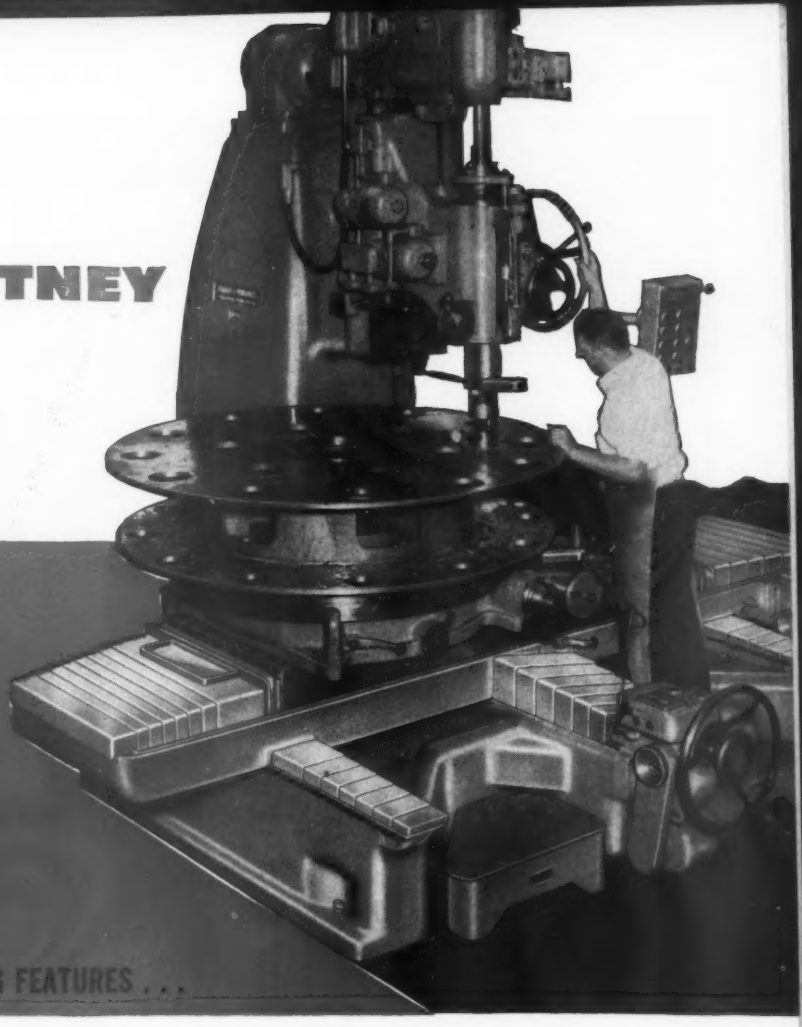
Yours with a

PRATT & WHITNEY

UMBER 4E

Electrolimit

JIG BORER



WITH THESE ADDITIONAL OUTSTANDING FEATURES . . .

THE NEW P&W *Electrolimit* MEASURING SYSTEM

This entirely new method of locating the table is fast, extremely accurate, absolutely positive and easy to use. There are no contacting surfaces and, therefore, no wear; the original high accuracy is retained indefinitely.

LARGEST CAPACITY OF ANY JIG BORER BUILT

The big 36 inch by 72 inch table handles work loads up to a full 5,000 pounds. Longitudinal table travel is 60 inches; transverse travel is 36 inches. Maximum distance from table top to spindle end is 47 inches.

ther PRATT & WHITNEY *Electrolimit* JIG BORERS

THE 1E — compact and versatile with table sizes of 12" x 24" and 12" x 42".

THE 2E — practical size for the average tool room with 22" x 44" table.

And now on the way — THE 3E — with 28" x 56" table.

• P&W OPEN SIDE CONSTRUCTION

A greater variety of irregular shapes and larger work sizes are handled with a speed, ease and convenience impossible with any other type of jig borer construction.

• CENTRALIZED PUSH-BUTTON CONTROL

All controls are readily accessible from a single operating position. Electric push-button controls for all motions plus speed and feed selectors are centralized on a single adjustable station.

PRATT & WHITNEY End Measure JIG BORERS

We will continue to manufacture this famous line. Featuring the same Ball Roll Quill spindle and the same high precision performance as the Series "E", they are equipped with End Measures instead of the *Electrolimit* Measuring System.

Circular No. 556

PRATT & WHITNEY
DIVISION NILES-BEMENT-POND COMPANY
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Accuracy ±.000008"

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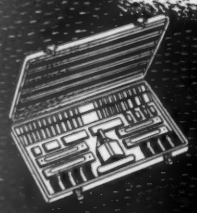

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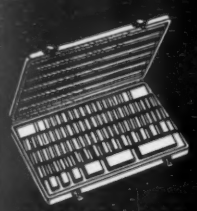
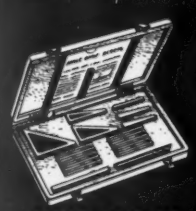


STANDARD STEEL BLOCKS

CROBLOX CARBIDE



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Quality and precision have not been compromised in this undertaking. Ask those who use them. Write for literature.

Webber

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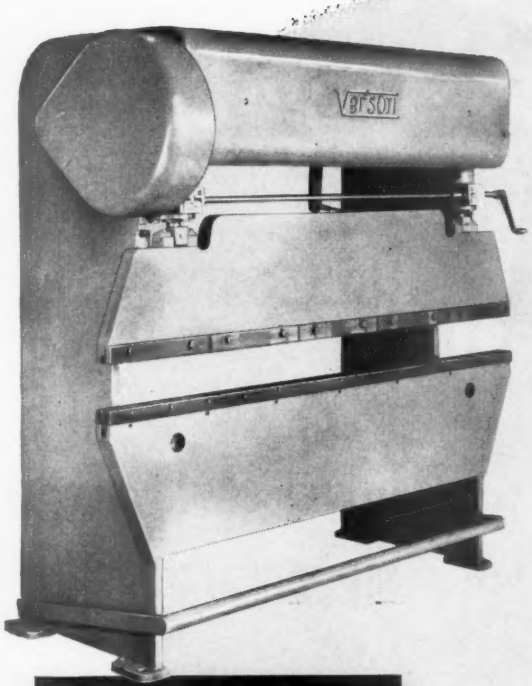
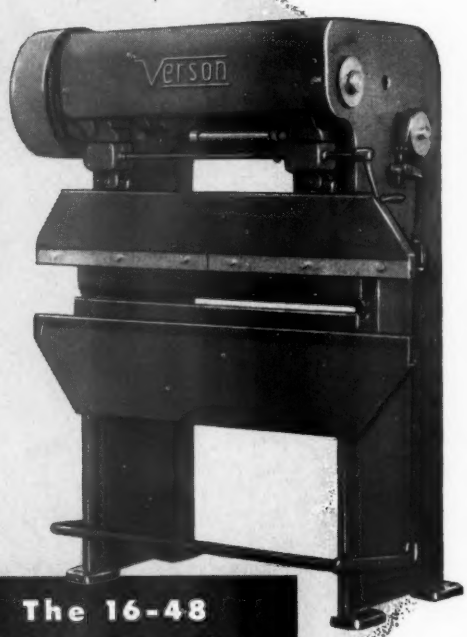


The 1062
25 tons capacity
(16 ga. x 78")
$2,190.00 as shown



The 16-48
15 tons capacity
(16 ga. x 48")
$1,455.00 as shown

Standard Dies Also Available

Standard 90° "V" dies for these press brakes are also available from stock. 78" long set for the 1062 is priced at $124.00. 48" long set for use in the 1062 or 16-48 is priced at $93.00. (Prices are for dies to handle 16 ga.).

To meet the demand for quality press brakes at modest cost and available for prompt delivery, Verson now offers two standard models *from stock.* For the small shop, it means big press standards of design and construction at prices that will fit almost any budget. For the larger shop, it means an economical answer to handling the smaller jobs without tying up big expensive machines.

Important, too, is the fact that you can order these machines as easily as buying an automobile. There is no involved proposal . . . no long delay awaiting delivery. These standard machines are offered at a standard price and shipped from stock.

Your Verson dealer can give you further information or write direct.

A Verson Press for every job from 60 tons up.

Verson

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

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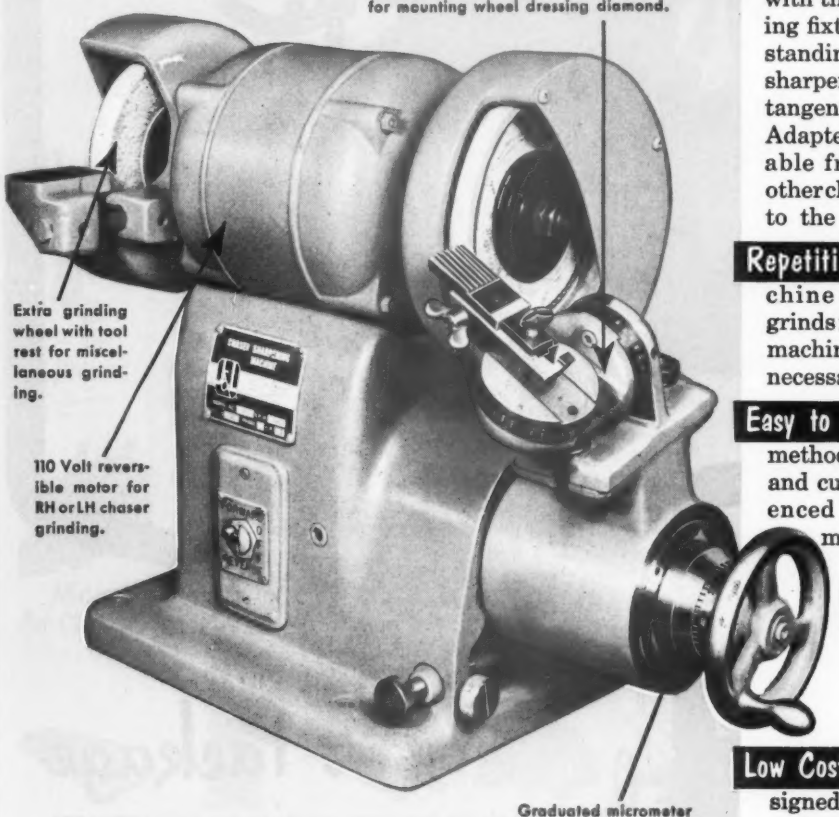
CIRCLE INFORM-A-GRAM KEY NO. 14

NEW

JONES & LAMSON UNIVERSAL BENCH TYPE CHASER SHARPENING MACHINE

Specifically designed to resharpen chasers, this *Low Cost*, space saving machine allows you to free heavy expensive machine tools for their intended uses, and at the same time do a better job of chaser sharpening. *It's good for miscellaneous small tool and cutter grinding too.*


J & L Universal Grinding Fixture with tangent chaser. Basic fixture has provision for mounting wheel dressing diamond.
Extra grinding wheel with tool rest for miscellaneous grinding.
110 Volt reversible motor for RH or LH chaser grinding.
Graduated micrometer dial to control infeed.

Grinder set up to resharpen J & L Tangent chasers

Universal Application Equipped with the new J & L chaser grinding fixture and adapters, an outstanding job will be done on all sharpening operations, for both tangent and radial die chasers. Adapters for J & L chasers available from stock. Adapters for other chasers can easily be applied to the chaser grinding fixture.

Repetitive Accuracy This machine will duplicate desired grinds repeatedly. It is a precision machine tool equipped with all necessary stops and controls.

Easy to Operate Simple, direct methods speed up the operation and cut costs. Even an inexperienced operator can, in a few minutes, learn to resharpen chasers on this machine.

Saves Space BENCH SPACE 14 x 28 inches is ample for your complete chaser resharpening operation.

Low Cost This complete unit, designed to do your entire chaser resharpening job, sells for only a small fraction of the cost of other bulkier machines often used. Why not install one in your plant, and release your heavier, bulkier machines for their intended uses?

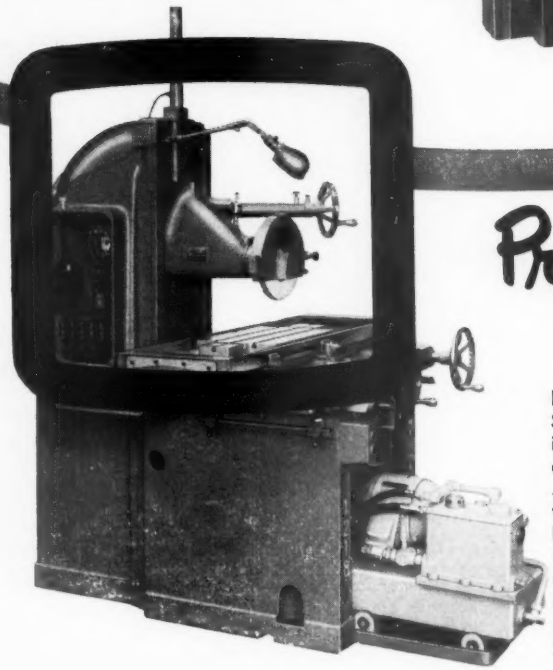
P.S. *Because of its size this machine can well be a time saver in shops where cutter grinding rooms are at distant points from the machines where dies are used. Write Dept. 710G for further details.*

JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 519 Clinton St., Dept. 710, Springfield, Vt., U.S.A. J&L DIE HEAD DIVISION

CIRCLE INFORM-A-GRAM KEY NO. 15



Precision in a Package

Here's the motorized spindle of the 1218 HYDRABRASIVE SURFACE GRINDER — the last word in hydraulically operated grinders. This piece of packaged precision delivers 3 HP direct to the 12" grinding wheel . . . for taking heavy cuts, for producing fine finishes, for maintaining the ultimate in flatness on every job. No. 1218 specifications include: wide cross travel (12") and moderate table length (18"); saddle ball ways; wide range of table speeds; accessories for wet or dry grinding. Send for latest complete catalog. Abrasive Machine Tool Company, **16** Dunellen Road, East Providence 14, Rhode Island.

Abrasive Quality is Reflected in the Finish of Your Product

ABRASIVE
ACCURACY BOOSTS PRODUCTION

CIRCLE INFORM-A-GRAM KEY NO. 16

New MEAD INDUSTRIAL AIR POWER CATALOG ready—

Full of suggestions FOR FASTER, CHEAPER PRODUCTION

New MEAD AIR POWER CATALOG illustrates, describes the complete line of famous MEAD-DESIGNED Air Operated Devices which have been speeding work, saving time and money for America's most "Cost Conscious" plants! Get your copy.

IT PICTURES THESE AIR-OPERATED DEVICES

Tear out memo coupon— to remind you —or better yet mail coupon now!

*Originators of the famous Air-Clamp** and **MEAD AIR OPERATED DEVICES**

MEAD SPECIALTIES COMPANY
4114 North Knox Ave., Dept. HA-14
Chicago 41, Illinois

Memo Coupon

MEAD SPECIALTIES CO.
4114 N. Knox Ave., Dept. HA-14, Chicago 41, Ill.
Send free copy of new, colored MEAD INDUSTRIAL AIR POWER CATALOG describing the complete line of famous Mead air-operated devices.

Name_____

Company_____

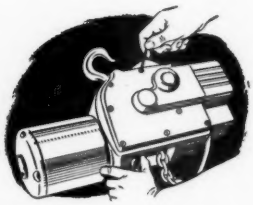
Address_____

City_____ Zone____ State____

CIRCLE INFORM-A-GRAM KEY NO. 17

23 UNBRAKO Socket Head Cap Screws are used to assemble this lightweight, high efficiency electric hoist. They were selected for their uniform accuracy and high tensile strength.

The knurling on the head of UNBRAKO Socket Head Cap Screws permits faster assembly, because of the positive slip-proof grip.



The uniform depth and size of the hex socket assure strength and maximum torque in wrenching—extremely important in the cap screws used to fasten assemblies like this.

UNBRAKOS—made of heat treated alloy steel—have fully formed threads, Class 3 fit; controlled fillet and continuous grain flow for strength. In standard sizes from # 4 to 1".

Save time and money by using UNBRAKO Standards...stocked by your distributor

You'll have less money tied up in inventory, you'll need less space for storage, you'll get personalized service and faster deliveries. And you'll be buying the finest socket screw products that modern machines, complete facilities and quality control can produce. Write for UNBRAKO Standards, a complete listing of socket screw products made by the world's largest producer. STANDARD PRESSED STEEL Co., Jenkintown 36, Pa.

UNBRAKO® SOCKET SCREW DIVISION

SPS JENKINTOWN PENNSYLVANIA

CIRCLE INFORM-A-GRAM KEY NO. 18

A SPINDLE YOU CAN *Specify* WITH CONFIDENCE

THE POPE PRECISION SPINDLE

1 HP, 3600 RPM MOTORIZED

with Super Precision Roller Bearings and Separate Thrust Bearings

The picture shows you why this Spindle has swept the field for 6" x 18" surface grinder application (producing finer finishes at lower cost)—and why it has been promptly drafted for hundreds of other jobs.

There are many types of bearings but none can approach the superb combination of ruggedness and precision found in the double row cylindrical roller bearings you see in this Spindle. They have tremendous load carrying capacity, produce a superior finish and assure long, trouble-free operation.

Note the thrust bearings. There is no endwise movement of the shaft in either direction.

Spindles have the Pope System of lubrication and are dynamically balanced in full assembly.

Applicable to all new grinders and to those now in service. Write for price and delivery.

No. 95

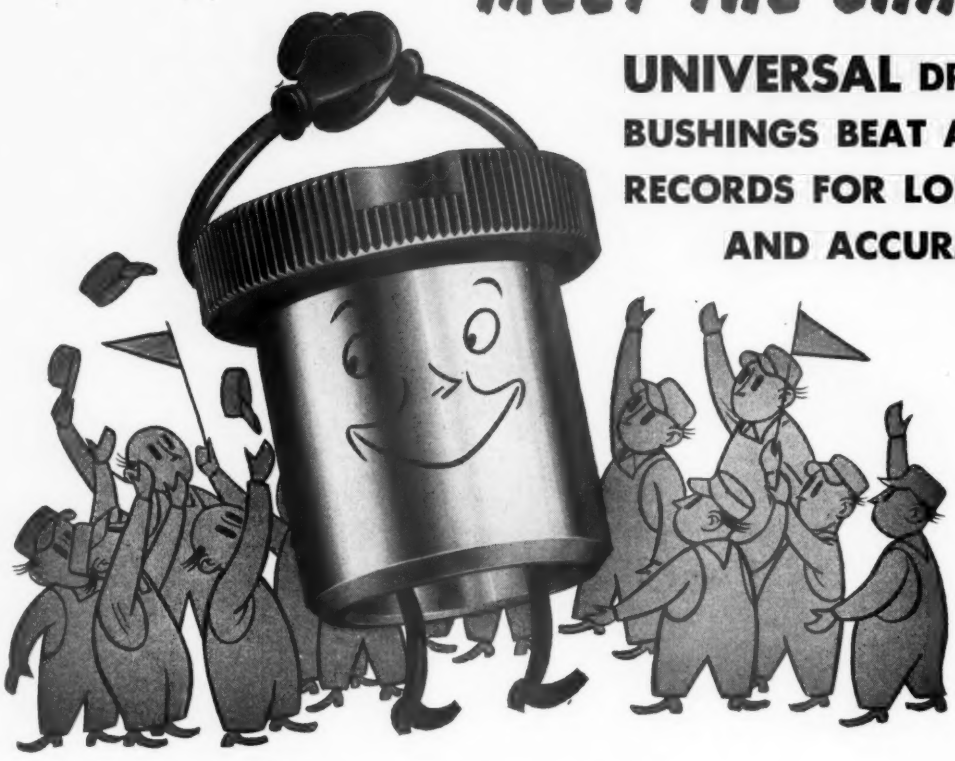
Specify **POPE** PRECISION SPINDLES

POPE MACHINERY CORPORATION
Established 1920
261 RIVER STREET · HAVERHILL, MASSACHUSETTS

CIRCLE INFORM-A-GRAM KEY NO. 19

MEET THE CHAMP!

UNIVERSAL DRILL BUSHINGS BEAT ALL RECORDS FOR LONG LIFE AND ACCURACY



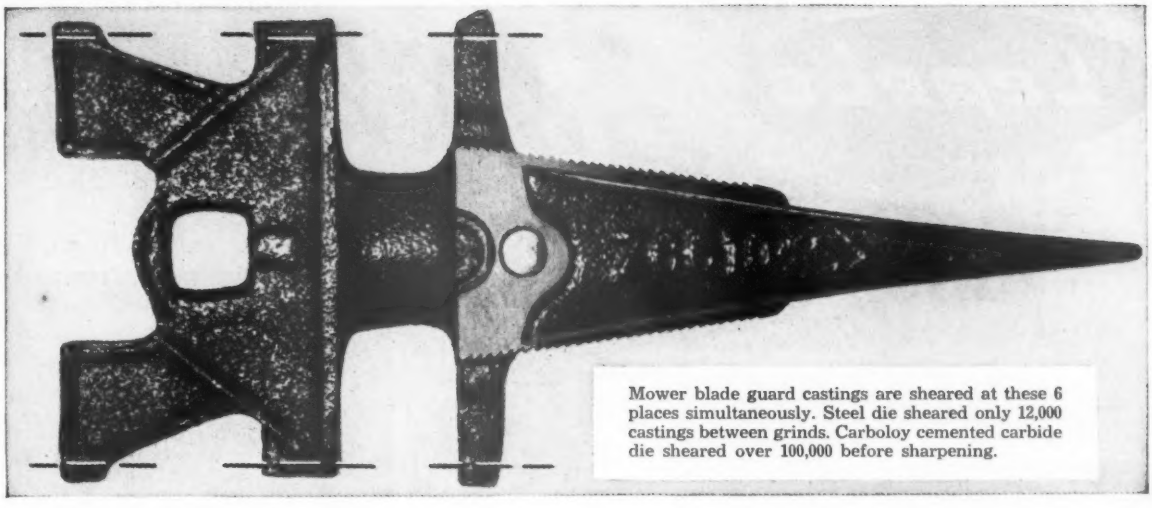
The extremely long life of Universal Drill Bushings is due to several factors. They are machined from finest quality steel. Their superhoned bores help to reduce both wear of the bushing and wear of the tools. Blended radius on the top inside diameter helps prevent tool hang-up and breakage. 100% concentricity and hardness tests insure accuracy and uniform quality. Knurled heads provide a quick, sure grip. Available in a complete range of standard sizes and lengths. Orders for special dimensions will receive prompt attention. For complete information, write to the office nearest you—Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.—or our home office.

179

UNIVERSAL ENGINEERING COMPANY
FRANKENMUTH 8
MICHIGAN

1 STANDARD COLLET CHUCK
2 FLOATING COLLET CHUCK
3 BORING CHUCK
4 "KWIK-SWITCH" TOOL HOLDER
5 MIKRO-LOK BORING BAR
6 STANDARD DRILL BUSHING
7 UNIVERSAL INDEX PLUNGER

CIRCLE INFORM-A-GRAM KEY NO. 20



Mower blade guard castings are sheared at these 6 places simultaneously. Steel die sheared only 12,000 castings between grinds. Carboloy cemented carbide die sheared over 100,000 before sharpening.

OLIVER CORPORATION REPORTS—

Carbide inserts increase die life over 800%!

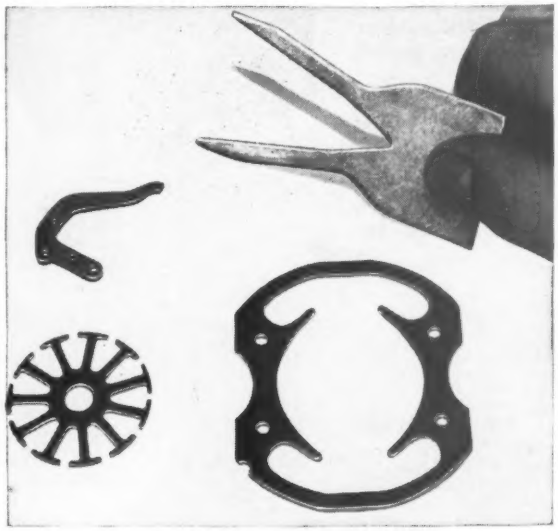
Carboloy cemented carbide on cutting edges of trim block shearing die increased production from 12,000 to well over 100,000 pieces between grinds!

When the Oliver Corporation switched from a steel die to a die equipped with Carboloy cemented carbide, things happened!

Carbide's stay-sharp-longer feature increased trim block life from one day to more than 8 days between grinds. It increased production, lowered maintenance costs, cut rejects, slashed downtime. There was no chipping or cracking of carbide under continuous impact; little grinding was needed to restore cutting edge.

Perhaps you have a die job – simple or complex, large or small – where you can get the same benefits. If so, have a Carboloy representative stop at your plant, show you how easily Carboloy cemented carbides can be profitably applied to almost any blanking, forming, drawing or piercing die.

Send coupon for free Carboloy Die Engineering Manual D-124 containing details on carbide applications.



Typical parts being produced by industry on carbide dies. Dies of Carboloy cemented carbide outlast steel dies 10 to 50 times. Produce burr-free, close tolerance parts with a minimum of maintenance and downtime.

"Carboloy" is the registered trademark for the products of the Carboloy Department of General Electric Company

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

MAIL TODAY

CARBOLOY Department of General Electric Company
11111 E. 8 Mile Blvd., Detroit 32, Michigan

Gentlemen:
☐ Send me, free, your helpful Die Engineering Manual D-124.
☐ Have a Carboloy representative call at my plant.

Name_____ Position_____

Company_____

Address_____

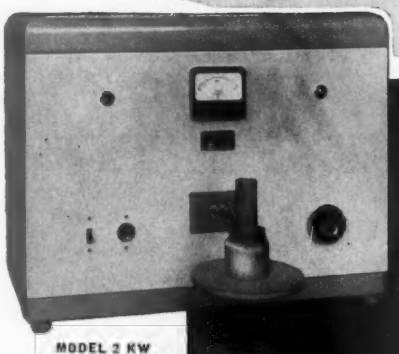
City_____ Zone____ State_____

CIRCLE INFORM-A-GRAM KEY NO. 21

Lepel's 3 new

LOW COST - PORTABLE
HIGH FREQUENCY
Induction
HEATING UNITS

MODEL T-2½-I
Electronic Tube Operated
$1620.
f.o.b. factory



MODEL 2 KW
Spark Gap Operated
$870.
f.o.b. factory

Ideal for

- Production Heating of small parts
- Research Laboratories
- Tool Rooms
- Machine Shops
- Educational Institutions

MODEL T-I
Electronic Tube Operated
$885.
f.o.b. factory

The Lepel line of induction heating units represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for industrial heating. With a background of half a century of pioneering electrical and metallurgical experience, the name Lepel has become the symbol of induction heating equipment embodying the highest standards of engineering achievement, dependable low cost operation and safety.

Amazing in its speed, Lepel equipment reduces the time required for hardening, annealing, stress relieving, brazing, soldering and melting from minutes to seconds. It performs these operations with a degree of precision and uniformity rarely attained through other processes.

LEPEL Electronic Tube GENERATORS available from 1 kw to 100 kw.
LEPEL Spark Gap CONVERTERS available from 2 kw to 30 kw.

WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information on high frequency induction heating.

BRAZING
Permits widest choice of silver or copper brazing alloys from lowest to highest melting points. Ideal for brazing carbide tips.

HARDENING
Heat localized exactly where wanted at desired temperature. Ideal for gears, cams, bearing surfaces, cutting tools and other areas that are subject to wear.

SOLDERING
Speedily and neatly performs intricate soldering applications with or without the use of preformed rings.

ANNEALING
Ideal for annealing, stress-relieving, normalizing or pre-heating selected areas.

MELTING
Readily melts quantities of ferrous and non-ferrous metals in either graphite or ceramic crucibles.

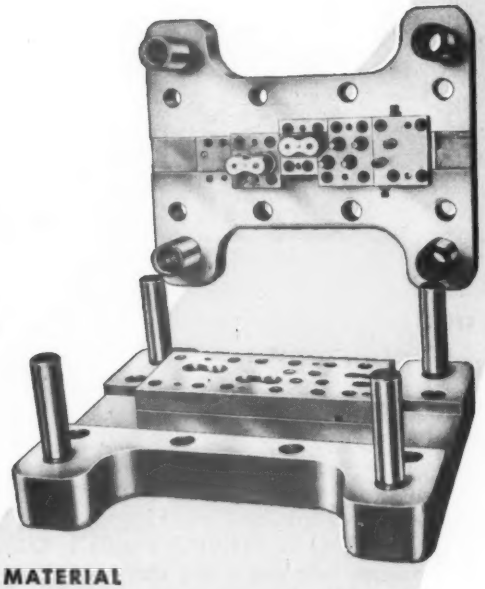
All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

LEPEL HIGH FREQUENCY LABORATORIES, INC.
55th STREET and 37th AVENUE, WOODSIDE 77, NEW YORK CITY, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 22

WHITNEY CHAIN

links up with... PRODUCTO DIE SETS



MATERIAL

1/4" SAE 3140 hot rolled steel in coiled stock.

OPERATIONS

Station No. 1 — Whitney Chain markings clearly embossed on each link.

Station No. 2 — Four holes, two to a link, rough pierced.

Station No. 3 — Two chain links blanked out on each press stroke.

TOLERANCES

Hole diameter + .0005" — .0005"
Hole centers + .001" — .001"
Link Contour + .005" — .010"
Die Set face parallel to feed slot + .002" — .002"

PRODUCTION RATE

153,000 links blanked per 40 hour week.
Between grinds, 75,000 pieces.

NEED PROMPT SERVICE?
CALL YOUR NEAREST
PRODUCTO ASSEMBLY BRANCH

Tough, 1/4 inch-thick hot rolled steel chain links are not an easy stamping job . . . especially when heavy production must be matched with close tolerances and excellent finish.

Here are the figures as this job rolls along at Whitney Chain on Niagara presses equipped with PRODUCTO 4-pin progressive die sets. It's typical of the way Producto Service teams up to set production records.

THE PRODUCTO MACHINE COMPANY
970 Housatonic Ave., Bridgeport 1, Connecticut

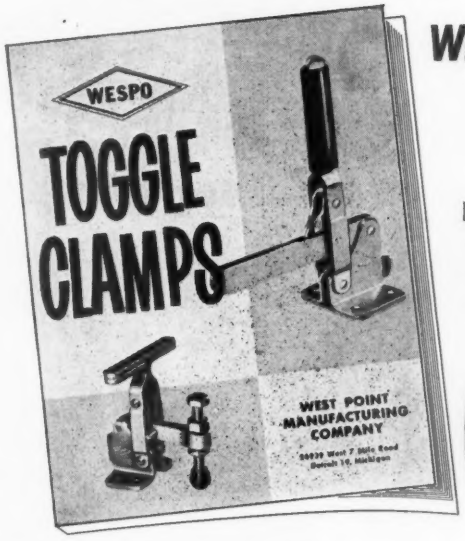
For Precision Die Sets *Fast* Call...

PRODUCTO

ALSO MAKERS OF TOOL AND DIEMAKERS ACCESSORIES, VISES, MACHINERY

3PD52A

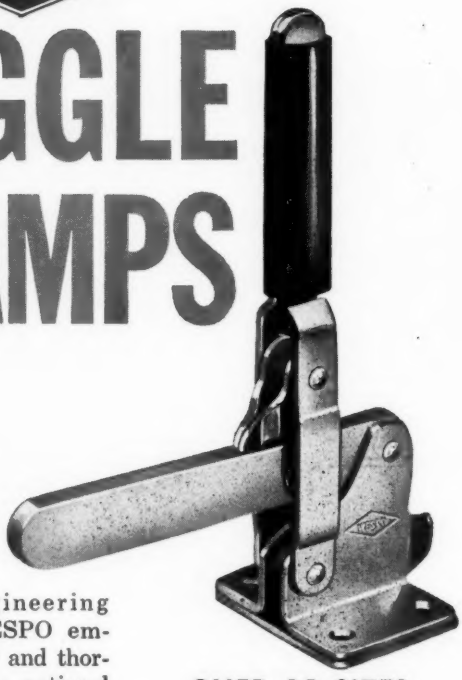
CIRCLE INFORM-A-GRAM KEY NO. 23



Write for FREE TEMPLATE CATALOG

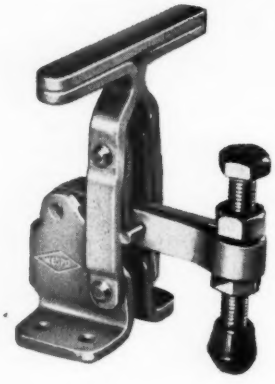
WESPO

TOGGLE CLAMPS



WESPO Improved Design and Construction Increase Toggle Clamp Life

WESPO announces a new complete line of toggle clamps specially designed for fast, sure and positive work-holding, efficient clamping and extra long clamp life.



In designing and engineering TOOGLE CLAMPS, WESPO employed the same long study and thorough research that earned a national reputation for WESPO fixture clamps and components.

OVER 35 SIZES AVAILABLE

Hardened steel bushings and pins reduce wear at bearing points, giving longer life as well as easier, faster action.

WESPO toggle clamps come in 35 styles and sizes for light, medium and heavy pressure loads—80 lbs. to 1600 lbs.

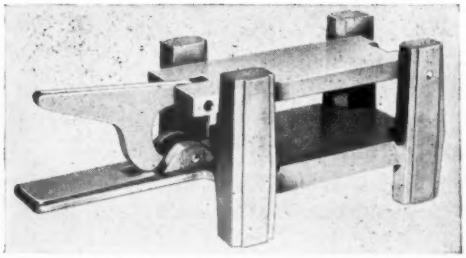
WRITE FOR TEMPLATE SHEET CATALOG

New WESPO LEAF JIG

SAVES OVER 50% IN DESIGNING TIME AND TOOL MAKERS COSTS FOR CUSTOM BUILT JIGS

Ready for immediate use for drilling, tapping and reaming—by merely nesting part and inserting bushings.

Precision made steel lid and cams, semi-steel body—.002 parallelism held between lid and machined base. Used in any position—top-bottom-2 sides. Install a new lid for a different operation.



23 sizes—1½" x 2" to 6" x 6"—2-3 heights each

TEMPLATE sheets available. Send for bulletin

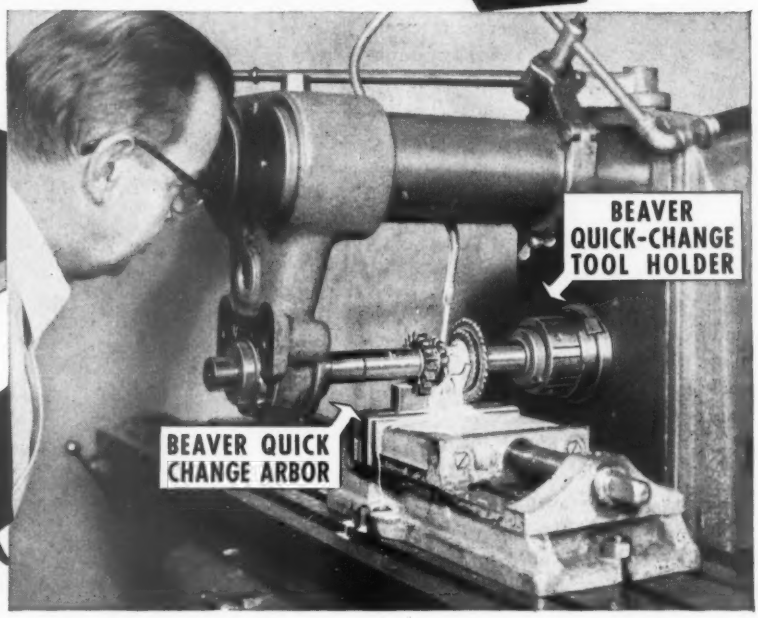
WESPO **WEST POINT MFG. CO.** WESPO

26935 WEST SEVEN MILE ROAD, DETROIT 19, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 24

Save MACHINE DOWN-TIME

WITH Beaver QU
CHANGE TOOLING P
SET AT THE BENCH



Beaver Quick-Change Arbors for all slotting, face, straddle, and gang milling save machine time, improve quality, and hold accuracy on single, multiple, and transfer machine operations.

By using Beaver Quick-Change Arbors in Beaver Quick-Change Holders on your machines, down-time can be confined to the bench. This allows uninterrupted machine operation without costly reset-ups with each change of tools.

Beaver Quick-Change Arbors reduce trial and error rejects by holding a constant relationship between the flange and the collar of the arbor. Spacing of cutters can be accurately predetermined at the bench with simple "Jo" blocks or height gage and indicator.

With Beaver Quick-Change Arbors your machines are free of costly down-time and cutter change from one set-up to another is a simple, quick operation. Prove Beaver Quick-Change Toolings superiority on your own operations.

STANDARD MACHINE TOOL ACCESSORIES CARRIED IN STOCK

Beaver TOOL AND ENGINEERING CORPORATION

BOX 429, ROYAL OAK, MICH. Teletype—Big Beaver 648

CIRCLE INFORM-A-GRAM KEY NO. 25

13 Key Moore Tools help put the PRECISION in Harig Dies

KARL HARIG

"When owner-management invests its money in machinery," says Karl Harig, founder and president of Harig Manufacturing Corporation, "it does so only after a thorough analysis and careful selection of available equipment." So it's significant that Harig, one of America's foremost producers of carbide, lamination, progressive, stamping and other types of precision dies, employs 13 Moore precision-built machine tools for many of its most critical toolroom operations.

A trip through Harig's modern Chicago plant reveals:

3 MOORE JIG BORERS, for accurate locating and boring of holes in a fraction of the time required by other means;

6 MOORE JIG GRINDERS, for relocating and grinding of holes and contours—within tenths—after hardening;

3 MOORE PANTO-CRUSH WHEEL DRESSERS, for speedy, cost-cutting performance of both crush-forming and diamond-dressing on the wheel spindle of a surface grinder;

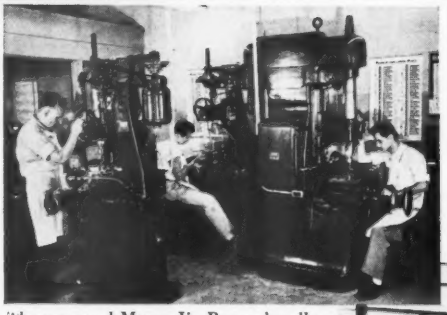
1 MOORE DIE FLIPPER, for "mechanized" die tryouts and assembly.

The combination of Harig craftsmanship and Moore precision tools has been an important factor in Harig's successful effort to meet continuing demands for faster production of intricate dies, tools, jigs, fixtures and gauges.

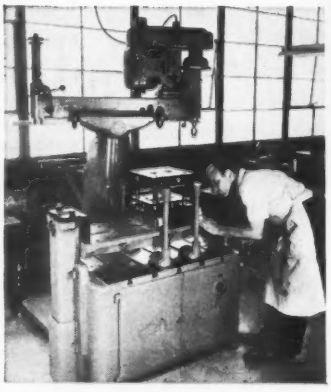
Why not discover how Moore tools can bring more speed and greater accuracy to *your* toolroom. Write today for our detailed literature.

Moore Special Tool Company, Inc.
726 Union Avenue, Bridgeport 7, Connecticut

A battery of six Moore Jig Grinders performs precision internal and contour grinding operations on sectional die parts at the Harig plant.


Three rugged Moore Jig Borers handle the bulk of Harig's critical spotting, drilling, boring and reaming operations.

Harig uses this Moore Panto-Crush Wheel Dresser on a surface grinder for fast pantograph profile grinding. Harig also has two more of these cost-cutting units.


A Moore Die Flipper facilitates accurate die tryouts and assembly at Harig, replaces time-consuming hand-labor methods.

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTO-CRUSH WHEEL DRESSERS • DIE FLIPPERS • MOTORIZED CENTERS • HOLE LOCATION ACCESSORIES

see our catalog in MACHINE TOOL CATALOGS or write for copy

CIRCLE INFORM-A-GRAM KEY NO. 26

Announcing....

a New addition to our popular line of SELECTIVE FEEDING DEVICES

NOW! A FEEDING UNIT FOR ALMOST ANY SPECIFIC APPLICATION!

Also EXTENDED ENGINEERING SERVICE—

ENABLING US TO DO THE COMPLETE TOOLING FOR YOUR INDIVIDUAL FEEDING OPERATIONS

New!

DPS BOWL-FEEDER

A proved method based on the VIBRATORY PRINCIPLE. Provides fully automatic, oriented, single line feeding to Grinding, Packaging, Inspecting and many other automatic machines and operations. Will scientifically feed light, fragile parts that normally could not withstand tumbling.

DPS BARREL-FEEDER

For years our popular unit, successfully used in thousands of plants to help speed production and reduce costs. They were designed with the idea of simplicity in operation and maximum feeding, handling a wide variety of parts. Designed for constant operation.

Write Us—Give Details and learn how our trained engineers can supply the answer to your feeding requirements.

DETROIT POWER SCREWDRIVER CO.

2827 W. FORT STREET, DETROIT 16, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 27

Collet "A"
Actual Size

Collet "B"
Actual Size

Can you identify these HARDINGE ELMIRA, N.Y. Collets?

Collet "A"

CAPACITY: 1" Round, 7/8" Hexagon, 3/4" Square
USED ON: Hardinge Lathes, Millers, Second Operation Machines, Chucking Machines, Index Fixtures and Sjogren Chucks. Also used with 10" South Bend, 10" Monarch, Sheldon, Rivett and Elgin Lathes; Schauer Polishing Machines; Mead and Zagar Fixtures.

Collet "B"

CAPACITY: 7/8" Round, 3/4" Hexagon, 5/8" Square
USED ON: 12" and 14" American; 14" Cincinnati; 12", 14" and 16" Hendey; 12", 14", 16" and 18" Monarch; 9", 15" and 16" Rockford; 12", 14" and 16" Sebastian; 14" and 16" Springfield Lathes.

Stock Delivery: Both Collets Carried in Stock for Immediate Delivery from Twelve Conveniently Located Warehouses. *Write Hardinge Brothers, Inc., Elmira, New York for Complete Bulletin 50.*

Answer: Collet "A" is a 5C Hardinge. Collet "B" is a 3H Hardinge.

CIRCLE INFORM-A-GRAM KEY NO. 28

DEVLIEG OF DETROIT

brings you a new comprehensive catalog featuring—

Microbore

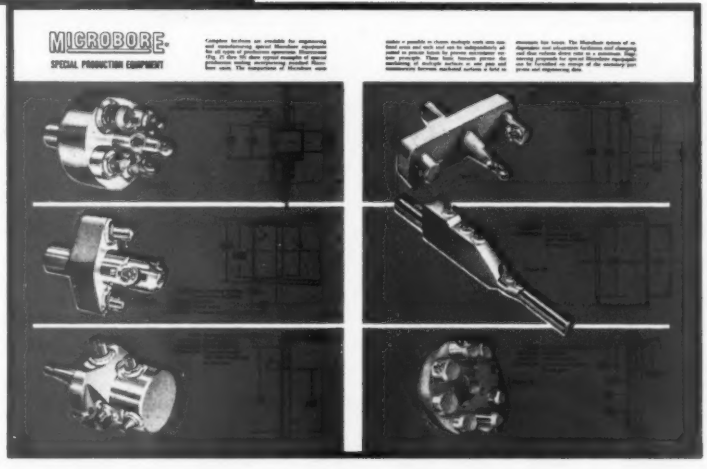
...the multipurpose single point adjustable tool for precision boring, turning and facing operations.

For General Purpose Work:

A wide range of standard Microbore boring bar sets is available for tool work and general purpose boring.

For Production Applications:

A complete service is available for engineering and manufacturing special Microbore equipment for all types of production operations.



A request on your company letterhead will bring a free copy of this catalog.

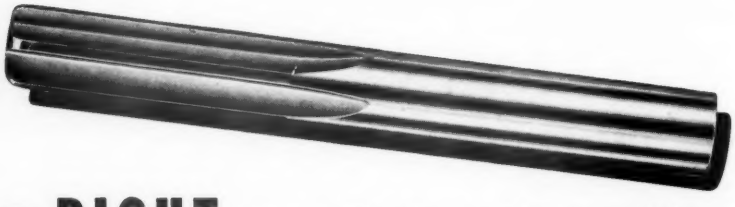
DEVLIEG MICROBORE CO. 480 Fair Avenue, Ferndale · Detroit 20, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 29

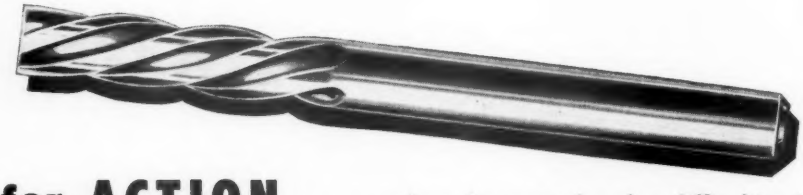
ATRAX

is for ATRAX . . . the finest of cutting tools.

is for TOUGH . . . they're *solid tungsten carbide.*



is for RIGHT . . . they're precision ground-from-the-solid.



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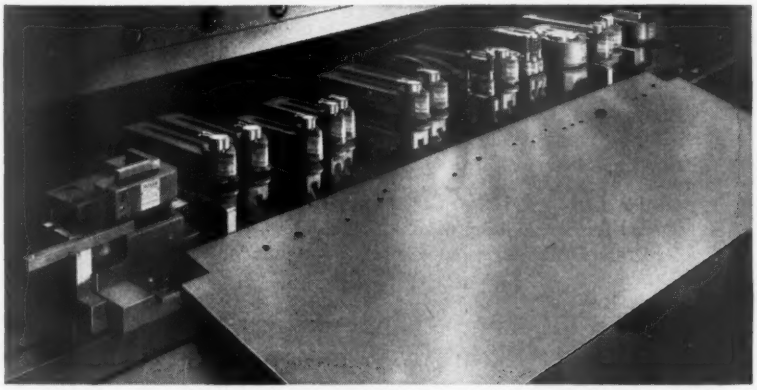
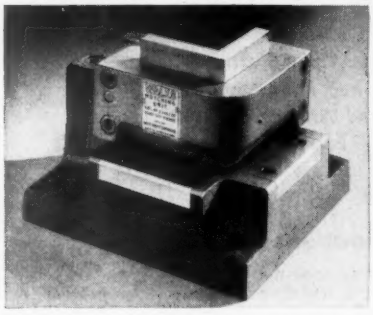
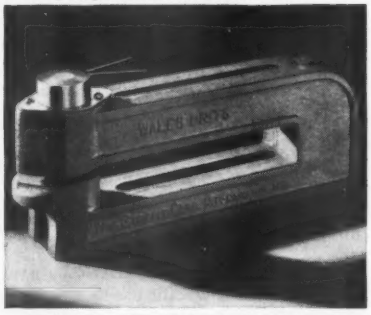
IT'S TOO BIG A STORY TO TELL ON THIS PAGE SO . . .



Showing a staggered hole punching setup of Wales Type "BL" Units with Wales Type "NA" Notching Units at each end for hole punching and notching in the same operation on a press brake. These same Wales Units may be set up in a stamping press as shown at bottom.



Wales Type "NA" Notching Unit for notching 90° corners.



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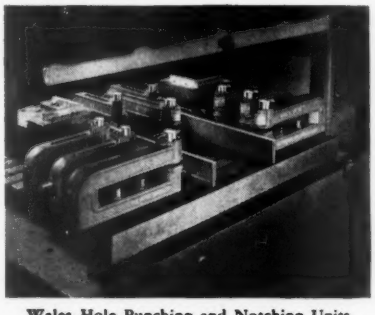
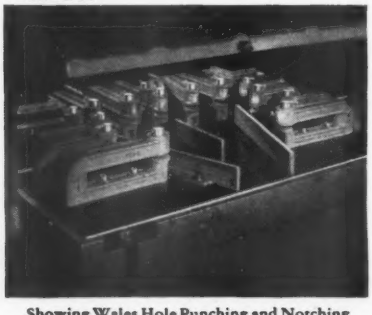


Wales Hole Punching and Notching Units set up on "T" Slotted Plate in a stamping press.



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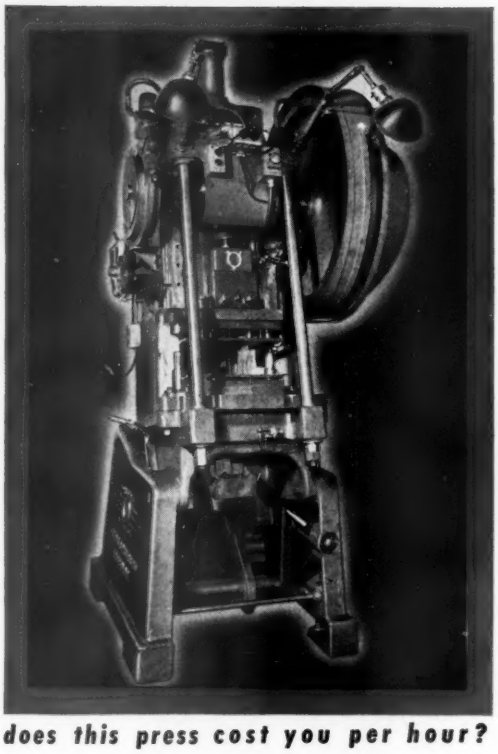

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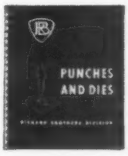

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CIRCLE INFORM-A-GRAM KEY NO. 34

costs . . . the challenge of 1954

One hardly needs a highly polished crystal ball in order to predict that 1954 will be a year of unprecedented attainments in production cost reduction. The greater the transition from a sellers' market to the highly competitive buyers' market (already with us as regards many products) the greater will be the pressures exerted by management upon those responsible for production to reduce unit costs of manufacture.

Our postwar economy has boomed many a manufacturing enterprise into a precarious state of existence; poorly fortified to withstand the attacks of the kind of competition which spells a buyers' market.

It will no longer hold that a manufacturer can rely on those profits which come from the boomtime formula of simply producing more and, hence, accepting orders for more. 1954's profits are going to have to be extracted from reduced costs.

The years of unsatisfied user demand for end products — the sellers' market — have been, admittedly, years of phenomenally high production. But in too many instances that production was attained merely by doubling or tripling the currently prevailing methods of operation; increasing production rather than increasing productivity.

Now, with our foot in the door of 1954 what, specifically, do we see? We see that any manufacturer who has been lulled into a false sense of well-being is going to have to scramble, to dig far and deep, for every possible means whereby his production costs can be reduced. This he must do not only for the profit potential, but for survival. Strong words, yes; but he can rest assured that his competitor will be doing the same.

He must look with suspicion upon every prewar machine tool on his floor, realizing that "prewar" now means fifteen years.

What is it costing in maintenance dollars and production down-time to keep it running?

And when it is running, how does its productivity compare profit-wise with that of a new machine having more horsepower per spindle, more "beef" with which to withstand the pressures of carbide tooling, and greater job versatility in available speeds and feeds?

Obviously, it can't compare, and when it is costing him dollars that his competitor doesn't have to pay out, how can he hope to recover those dollars? Competition will no longer let him do it by increasing the selling price of his product.

He must overhaul his entire tooling program. He must register dissatisfaction with the widespread, static acceptance of the term "perishable tools" and take steps to replace perishable tools with less perishable. Perishable tools are perishable dollars.

He must give a long and critical look at his entire line-up of jigs and fixtures. If they do not represent the latest techniques in versatility, combining of operations, ease of loading and unloading, they are simply road-blocks slowing down the finished product's arrival at the shipping platform. Slowed down processing means slowed down dollars; lazy dollars.

The dollars the manufacturer has for allocating to production can be made to do more work by the employment of indexing fixtures, multiple spindle setups where one feed motion does the work previously done by several, magazine feeds whereby the workers' hands are freed for more productive efforts, air and hydraulic units which push and pull workpieces with greater velocity, accuracy, and safety than can human hands, and multi-station automatic dies which perform more fabricating operations per stroke of the press.

Our 1954 manufacturer must combine all of these cost-cutting, high output, tooling and production methods with the most exacting demands on his quality control operations. He must recognize that the cost cutting, waste eliminating, profit producing, and good will potentials of quality control are more far reaching than any other manufacturing function.

Quality control starts with incoming material and follows through to the most important element in the manufacturing picture — the customer; the court of last resort for all free enterprise.

These, then, are the ways by which we see today's manufacturer meeting the critical cost challenge of 1954. Collectively, they are what will enable him to meet competition; to stay in business. This is his obligation to himself, his employees, his customers, and his stockholders.

E. Willard Pennington

Editor

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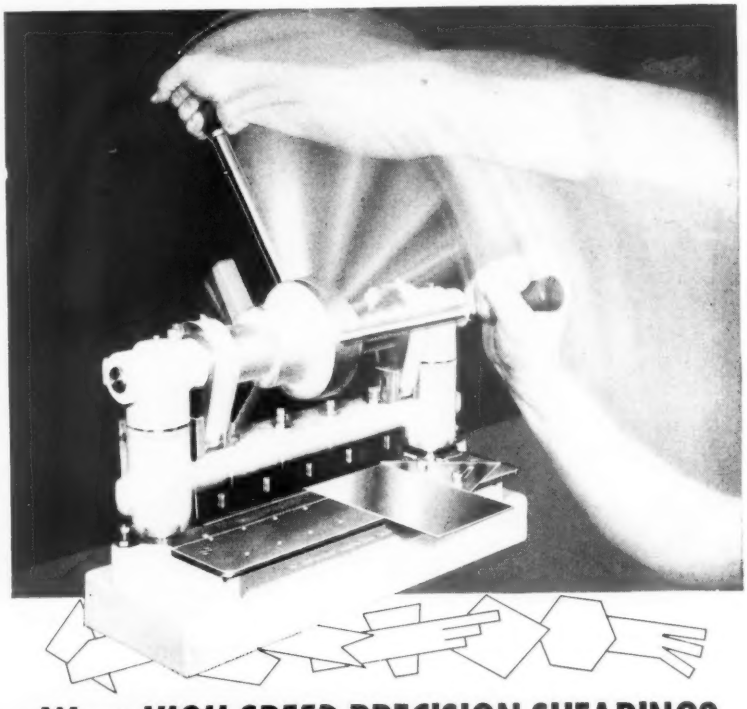

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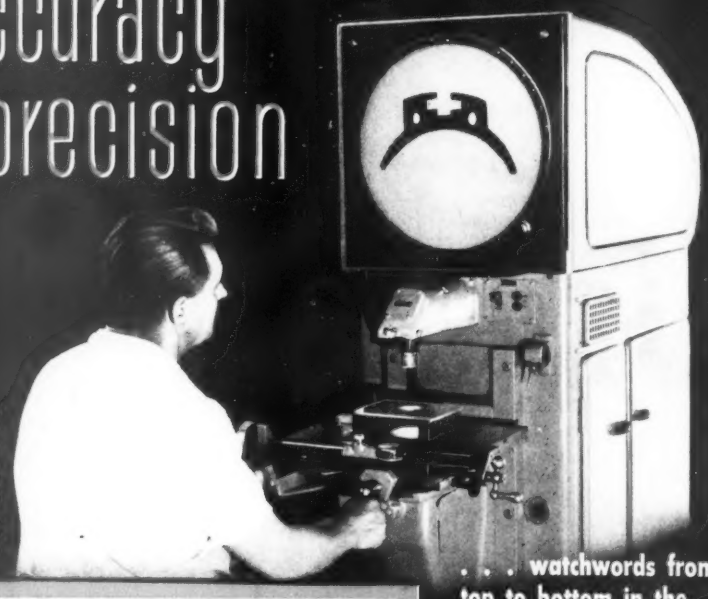

Comparing piece parts with tolerance drawings on Bausch & Lomb and Jones & Lamson comparators.

Another Harig Carbide die designed to out perform a comparable steel die ten to one.

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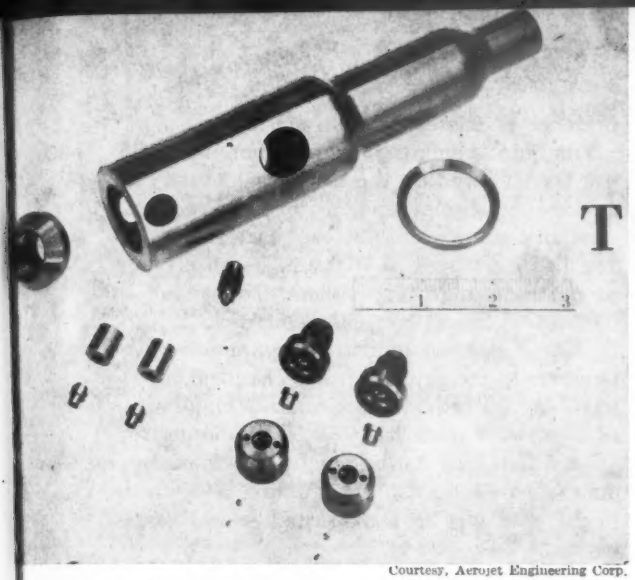


Courtesy, Aerojet Engineering Corp.

Titanium parts for a 50-lb thrust rocket, all made of commercially pure titanium (Ti-75A).

TITANIUM

. . . the Metal of 1954?

by Elmer H. Hahn, Jr.
Registered Professional Engineer
Cleveland, Ohio

IF PRESENT PROGRESS be taken as a criterion, the metal Titanium may well live up to its namesake, the Titans. While many problems in production and processing still exist, the amount of capital and effort being expended by both government and private agencies indicate a most promising future.

The biggest economic problem is the cost of refining, but research has made rapid strides and the solution is in sight. At present, Government defense demands take almost the entire supply, at prices which could not compete in a non-defense market. As defense demands become stabilized, however, private industry will find many additional uses for the remarkable qualities combined in this material. It is with this anticipated future supply and demand in mind that the present article is written.

Physical Properties

Titanium possesses an excellent strength-to-weight ratio, which is an important feature in many applications. This metal is comparable in strength to stainless steel, yet weighs only 56% as much. It maintains good strength up to temperatures of 800° to 1000° F, and also is highly resistant to most forms of corrosion.

Other outstanding properties include good modulus of elasticity, surface hardenability, resistance to natural corrosion, and high melting temperature. The properties of titanium appear to fall midway between stainless steel and aluminum, and will fill a gap which has long been recognized.

The formability of titanium is good, due to its favorable ductility. While not fully explored at present, all indications point to excellent alloying possibilities.

These are highly attractive qualities, but it must be remembered that titanium is not quite the "ideal metal." In common with other metals, it has its own peculiar short-comings. At room temperatures, the structural efficiencies of aluminum and magnesium alloys are slightly better than titanium. In this respect, titanium only excels the lighter metals in the temperature range above 400° F. Galling and wearing properties, as well as notch sensitivity, leave much to be desired.

Applications

Because of the supply problem, extensive use of titanium at present is planned only in military equipment, where performance regardless of cost cannot be compromised. Titanium's use in military aircraft will include jet engine components, airframe assemblies, accessory components, and airborne equipment. Use in ordnance equipment also may cover a wide range in gun components, ammunition, armor, tanks, and miscellaneous transportation equipment. Planned marine applications are more limited, but still of vital importance performance-wise. These include wet exhaust mufflers, condenser and heat exchanger tubes, meter discs for various liquids including sea

water, exposed antenna wires, steam turbine blades, and small high speed propellers and outboard shafting.

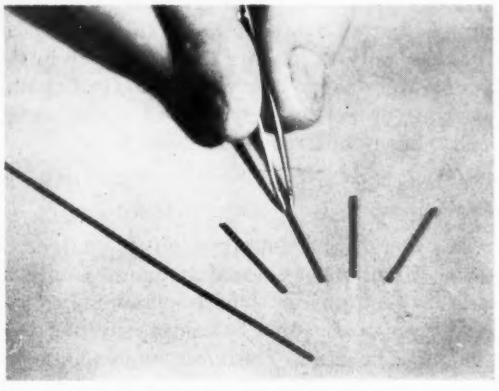
The applications possible when titanium becomes available for non-defense use seem to cover the entire industrial field. As with military equipment, it appears that certain components of commercial transportation equipment could be made of titanium alloy where reliable strength, life, and corrosion resistance offset costs which accumulate through frequent part replacement. In transportation equipment of all forms, lighter weight means more speed and less power.

Replacement of stainless steel by titanium on a volume basis would give an immediate reduction of around 40% in weight. Weight itself is often cumulative though. More weight means higher power requirements, which in turn mean a heavier power plant and the additional fuel to operate it. Titanium seems to be a must for presently planned and future high speed aircraft, whose basic requirements are high strength-weight, high temperature strength, and good corrosion resistance.

Titanium is also applicable to marine use where light weight and corrosion resistance are not inconsiderable factors. Qualities that are of particular interest to the U. S. Bureau of Ships are titanium's corrosion characteristics in marine environment, and its property retention in steam atmosphere and in the presence of Diesel exhaust gages.

Titanium, being strong and non-magnetic, has been viewed by the electrical industry as an excellent cable armor material. Producers of atomic energy and nuclear reactor products are also interested in titanium because of its properties at elevated temperatures as well as its neutron absorption characteristics.

Many classes of industrial equipment—particularly in the petroleum and chemical industries—would provide uses for this high corrosion resistant material. While all the desired applications may not be practical in the immediate future, the use of titanium is destined to increase just as fast as supply and prices permit.



TITANIUM TUBING

Titanium tubing in the ultra-small class has been successfully drawn from commercially pure titanium by Superior Tube Company of Norristown, Pa. This size—0.0455" O.D. and 0.0025" wall thickness—is now used experimentally in the electrical, electronic, and chemical industries. Photo shows several experimental cathodes for electronic application. All thin-walled titanium tubing is vacuum annealed to avoid embrittlement. A wide range of small tubing is produced in both seamless and welded grades. Superior reports that fusion welding has been successfully accomplished under an ample blanket of rigidly controlled inert atmosphere.

Availability

The availability of titanium ore presents a very bright picture. Titanium is the fourth (some authorities say the "fifth") most abundant structural element in the earth's crust, being 0.56%. **Ilmenite,** ferrous titanate ($FeTiO_3$), is the most important ore and deposits occur in Quebec, New York, Virginia, Florida, North Carolina, and Wyoming, Other deposits occur in Brazil, Japan, and India. **Rutile,** titanium dioxide (TiO_2), is the other naturally occuring form of titanium, and is widely scattered through many rock formations. The occurrence of sizeable rutile deposits roughly parallels that of ilmenite. As titanium production increases, the apparent abundance of ores may well be a factor in dictating the use of this metal.

The Kroll process is the most widely used method of refining titanim ore. Primarily this process consists of the reduction of titanium tetrachloride with magnesium. The resulting product is sponge metal. This method is feasible for the present limited production; however, metallurgists are far from satisfied with this process for higher production tonnages. Chemically pure titanium is produced by the iodide process for laboratory test qualities. The end product of this process is a small bar of solid ductile titanium.

An ultimate annual production goal of 100,000 tons would require 4 billion kilowatt hours of electricity, to refine 340,000 tons of ilmenite ore. The Kroll process would require in addition 450,000 tons of chlorine regeneration facilities and 110,000 tons of magnesium. The iodide process would require 1,080 tons of iodine.

The present cost of titanium sponge is $5

Properties of Titanium and Its Alloys

Pure Titanium

TO EVALUATE the properties of the commercial material, it is best to first examine the properties of the pure metal. The chemically "pure" metal at the present time is produced by the iodide process, and is 99.95% titanium, 0.002% nitrogen, 0.03% carbon, iron, silicon, or aluminum, and traces of oxygen. The pure metal is as weak and ductile as copper. The mechanical properties are as follows:

Ultimate Strength	30,000 psi
Yield Strength	15,000 psi
Elongation	55%
Area Reduction	80%
Vickers Hardness	60
Modulus of Elasticity	15 to 16 x 10^6 psi

The atomic number of titanium is 22; and the atomic weight, 47.9. Density is 4.50 gm/cc, or 0.163 lb/in.^{3} The crystalline structure is two phase, being hexagonal close-packed at lower temperatures and body-centered cubic at elevated temperatures. The transition temperature occurs in the neighborhood of 870° to 880° C. The melting point is 1725° C; and the boiling point, above 3000° C. The specific heat is 0.13. The electrical conductivity is 3.1% that of pure copper, and the metal is non-magnetic. The thermal expansion over the range 20° to 300° C. is 5.0 x 10—^{6} in./in./° F.

The beta, cubic structure existing at high temperatures cannot be held at room temperatures. Consequently, chemically pure titanium always has the hexagonal, alpha structure for all practical purposes. It is known that the transformation takes place by a shearing action which leaves a lemellar structure. Slow cooling rates allow the separation of this structure into equiazed grains oriented as before separation. Experimental work is not completed upon this directional orientation of grains, but it is known to have an important effect upon the plastic deformation qualities of the metal.

Titanium is a highly reactive metal, but like aluminum, chromium, and stainless steel it quickly develops a protective oxide film, which shields the surface from most corrosion. Furthermore, this protective film is more stable than that formed on the other metals. Corrosion resistance of titanium is high in respect to most chemicals.

Tests have proven titanium extremely resistant to all forms of natural corrosion and erosion, particularly in sea water. Corrosion fatigue resistance is also high. In association with other metals, titanium ranks just above silver in the Galvanic Series.

The most troublesome characteristic of titanium is its enormous appetite for nitrogen, oxygen, and carbon. These elements also have a decided effect upon physical properties of the metal. Strength is increased and ductility decreased by small proportions of carbon and nitrogen, and a few tenths percent of oxygen will cause high brittleness.

Above 2000° F, titanium will soak up large quantities of any oxygen or nitrogen present to the point where the resulting brittleness renders the metal useless. All melting must be performed in a vacuum or an inert atmosphere. Besides this affinity for normal atmospheric gases, the molten metal reacts with all known refractories.

Several melting techniques in use partly circumvent the difficulties. To date, only two crucible materials are used—water-cooled copper, and graphite—and the process is known as the shell or skull method. Graphite does not require the drastic cooling which copper does, and it permits larger size crucibles. Molten titanium in contact with either copper or carbon quickly forms a contaminated skin at the interface. This titanium-rich skin remains in the crucible and itself forms a container for further melts. While the pickup of impurities is not completely eliminated, this action is cut to a minimum.

Commercial Alloys

The mechanical properties of a representative commercially pure titanium are as follows:

Ti-75A (Titanium Metals Corp. of America)	
Ultimate Strength	70—80,000 psi
Yield Strength	45—55,000 psi
Elongation	20—30%
Area Reduction	45—70%
Vickers Hardness	175

Other properties are affected very slightly by the impurities present, except the modulus of elasticity. Small amounts of oxygen and nitrogen, as well as cold working, cause this property to vary from 15 to 18 x 10^6 psi. This metal also possesses high impact and fatigue properties from — 100° to + 1000° F.

Alloying of titanium produces the most valuable physical properties. Presently used alloying elements include aluminum, manganese, chromimu, iron, carbon, nitrogen, and oxygen.

Rem-Cru Titanium, Inc. reports laboratory samples with an ultimate strength as high as 200,000 psi, and a usable ductility. Rem-Cru Titanium, Inc. offers a manganese alloy, RC-130-A, and a manganese aluminum alloy, RC-130-B. The manganese alloy has a yield strength of approximately 110,000 psi, while retaining good ductility, and is recommended for sheets. The manganese aluminum alloy is less ductile, but still formable, and is recommended for forgings and bars. Both alloys are mixtures of alpha and beta phase titanium. Manganese principally strengthens the beta form, while aluminum strengthens the alpha form.

Titanium Metals Corp. of America produces the following alloys:

Ti—100A Oxygen-Nitrogen Alloy	100,000 ult. str.
Ti-125A Oxygen, Nitrogen, Chromium, Iron Alloy	125,000 ult. str.
Ti-150-A A higher quantity of Chromium and Iron make this alloy hardenable and heat treatable	150,000 ult. str.
Ti-175A Same properties as Ti-150A, but slightly higher percent of alloys	175,000 ult. str.

The alloys mentioned here, together with the Mallory-Sharon alloys shown later in chart form, are the principal ones now available.

For the same alloy, properties will vary somewhat in forms available to fabrication—forgings, sheets, bar, wire, etc.

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per pound. Fabricated into sheets, bars, tubes, and forgings, the cost runs from $20 to $30 per pound. The goal of producers is to reduce the cost to $1 to $2 per pound to put the metal in the competitive market. From these figures, it can be realized why the intensive search for new refining techniques is being pushed. The expected demand for this metal has already produced developments at a pace out of all proportion to similar developments in other metals.

Many different methods of extraction and refining are being investigated. The most intelligent deductions indicate that the final commercial tonnages will be produced by some form of the continuous electrolytic method.

The total production for 1953 will be about 2,500 tons, and 5,500 tons in 1954. The Office of Defense Mobilization would like to see production at a 22,000-ton rate by the end of 1955, but the present producers are pessimistic on this point. Up to a certain level, production will increase at a geometric rate; and a reasonable supply will be on hand within 4 to 5 years.

* * *

A Senate investigating committee was recently advised by Roy T. Hurley, board chairman of the Wright Aeronautical Division of Curtiss-Wright Aircraft, that if war came his company alone would need 72,000 tons of titanium to meet the competition of enemy aircraft.

* * *

Outlook

The scope for application of titanium is wide when the more distant future is contemplated. New alloys and techniques doubtlessly will

open up new uses which cannot now be predicted exactly. First, though, the problems of refining, casting, and scrap recovery at least

* * *

At the 1953 SAE National Aeronautic Meeting, the Production Forum on Titanium reported that recent tests on titanium alloy showed encouraging endurance limits of notched specimens. The notched fatigue properties are evidently not as serious as originally expected. It is probable that this condition will be improved further as a result of further improvement in uniformity of this metal.

* * *

must be solved in a more practical manner to make titanium the completely desirable metal.

The immediate outlook in titanium application is for a slow replacement of other metals which are in short supply or not completely suitable to a particular application. Titanium can be substituted for aluminum and magnesium where temperatures average around 300° to 400° F. There will be no substitution at room temperatures or in applications where electrical or thermal conductivity, or low density are of prime importance. Titanium will slowly replace stainless steel in many aircraft parts; and also stainless steel, nickel, and Monel in marine applications. Because of its good corrosion and heat resistant properties, this metal will slowly replace copper in the chemical and petroleum industries.

Most authorities expect the titanium industry to eventually assume about the proportions of the present stainless steel industry.

Handling and Fabrication

THE FORMS OF TITANIUM now available in limited quantities include bars, plates, sheets, strip, wire, welded and seamless tubing, forgings, and billets. Small extruded shapes will soon be on the market. Ingots of 1000 lbs. have been available for some time, and Rem-Cru Titanium reports ingots up to 4000 lbs. These larger ingot sizes mean that titanium sheets may be rolled on presently available steel mill rolling equipment.

So far as is known, no health hazards due to handling titanium exist. While the metal is not as inflammable as magnesium, the dust is as exposive as other metal dusts. Fine turnings can be ignited with an oxyacetylene torch. Good ventilation should be provided for grinding dust, and fine turnings should be stored in a safe manner. Titanium is as safe to machine as stainless steel. Water solvent coolants are

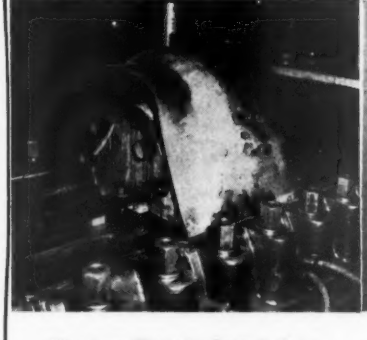
Stretch Forming

LIMITED TESTS have been conducted by the Aerojet Engineering Corp., Azusa, Cal. on the stretch forming of commercially pure titanium (Ti-75A). It was found that annealing had little effect on the high strength or low ductility of this metal.

An Erco stretch press and Kirksite die were employed. Inter-stage annealing temperature was held at 1350° F for 10 min.

On Tests No. 1 and 2, Keystone grease No. 84 was brushed on the die. Test No. 1—pressure was applied slowly, with ram speed of ⅜"/min. Failure occurred at 125,000 lbs ram force, with average elongation of 10.2% and maximum local stretch of 18.8%. Test No. 2—failure occurred after sixth anneal, with average elongation of 16.7%.

On Tests No. 3 and 4, the die was heated to 465° F and the blank painted with a molybdenum disulfide lubricant. Test No. 3—after slight stretching, all parts of blank not in contact with die were torch heated to 800° F. An asbestos blanket was thrown over blank. Pressure was released at intervals to heat the blank edges. Failure occurred after average stretch of 23.6% and maximum stretch of 33%. Test No. 4—similar to No. 3, except that the blank was removed and annealed at intervals. Failure occurred after average stretch of 38% and maximum local stretch of 73%.



Titanium Sheet in Stretch Press

Sheet Partially Formed, and Edge of Failure

Sheet Fully Stretched

recommended to prevent cutting oil iginition by sparks. To identify titanium, touching the metal to a grinding wheel will show white traces ending in brilliant white bursts. Moistened titanium rubbed on glass will leave a gray-white mark.

Forming

Very good results have been obtained in the deep drawing of commercially pure titanium sheet. Without special treatment, cups have been formed as easily as with stainless steel using the same dies. Because of titanium's somewhat slower flow characteristics, much more heat is generated. For this reason, surface lubrication must be maintained or a dry surface may occur due to boil-off of the lubricant.

Annealed sheet has very little directionality due to rolling. A sample of 0.095" thickness bent 180° at right angles to the rolling direction, may have as small a radius as twice the thickness; parallel to the rolling direction, 3 times the thickness. Half-hard and full-hard samples bent at right angles to the rolling direction require 4 times and 6 times the thickness respectively. Titanium sheet has a lower coefficient of friction than mild steel, 0.115 as against 0.175. With a phosphate coating, titanium's coefficient is 0.073, while steel is 0.069. Even though titanium takes the coating very well, it is evident that a better coating material is desired.

* * *

The Republic Aviation Company, Farmingdale, L. I., is reported to be investigating the possibility of warming titanium sheet to about 1000° F by fastening electrical contacts to the workpiece and running current through it while on the press table.

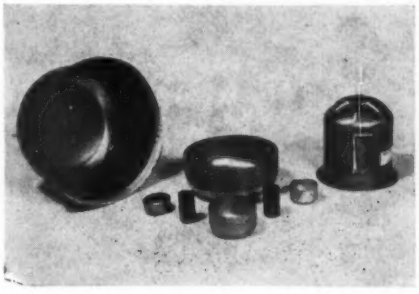
* * *

Riveting

The cold heading of Ti-75A or Rem-Cru RC-75 wire appears to offer no difficulty in conventional machines. Titanium Metals Corp. recommends a flash coating of copper on the wire stock if galling does occur. After cold working, the rivets or bolts have a tensile strength around 115,000 psi and the ductility has decreased to about 10%. Heating to 500° to 600° is necessary in the forming of large flush head rivets; otherwise, cracking occurs around the edges. In using these titanium rivets with other metals, attention should be paid to the Galvanic series to prevent Galvanic corrosion. This type of corrosion is negligible between Monel and titanium, and between stainless steel and titanium.

This progress report on "Titanium" will be continued in an early issue of Tooling & Production.

Drawing of Titanium



EARLY EXPERIMENTAL WORK on the shaping and forming of titanium at Worcester Pressed Steel Co., Worcester, Mass., was reported by J. Walter Gulliksen, General Superintendent, at the Titanium Symposium, Watertown Arsenal.

The commercially pure types have sufficient plasticity to be suitable for cold drawing at room temperatures, Gulliksen declared. There is a reasonable spread between the elastic limit and the ultimate strength, plus a 20 to 30% elongation. Using drawing tools of conventional design, initial reductions at room temperature have been made up to 40% from blank diameter to cup diameter, followed by redraws involving further reductions of 15 to 25%.

The frictional characteristics of the metal resulted in severe score marks and scratches in the formed part, and bad roughening of the die. The scratches were interpreted by Gulliksen as meaning that minute particles of titanium were being scraped from the surface of the material and cold welded to the die. The nodules thus formed would rip the next piece as would a file-like surface. The pressures required for drawing titanium are considerably greater than for mild steel and accentuated this problem. Chemical surface treatments, such as bonderizing and anodizing, and high pressure lubricants were found helpful.

Carbide tooling showed less tendency to scratch and gall than dies made from other materials such as bronze alloys, tool steel, and chromium plated metals.

The titanium work hardened so rapidly that it was necessary to stress relieve after each draw in order to restore sufficient ductility for subsequent forming. Stress relieving at about 1325° F, with the time factor varying from about two minutes for .010" material to seven minutes for .078" material, was found satisfactory. This was without controlled atmosphere, without quenching, only an air cool. However, considerable surface scaling was encountered; and, since titanium resists the action of normal pickling solution, it was necessary to resort to a process such as the DuPont or Hooker in order to restore proper surface conditions. Another possibility was revealed, that there may be a limit to the number of times the stress relief can be effective.

According to Gulliksen, the material is sensitive to the rate of deep drawing. It cannot be hurried and parts successfully produced were run at 1/2 to 2/3 the usual speed for mild steel. Another problem, which may have been temporary, was the need of greater uniformity in the material.

The above findings were based upon work with commercially pure titanium. Limited experience with titanium alloys indicated that they could not be drawn at room temperatures but that some might be drawable at elevated temperatures.

Methods of

STARTING AND STOPPING IN AUTOMATIC DIES

by Ernest J. Urbas
Superintendent, Tool and Die Dept.
THE GUARANTEE SPECIALTY MFG. CO.
Cleveland, Ohio

THE METHOD EMPLOYED in starting a strip of material in an automatic die is of primary importance for the ultimate success of trouble-free operation. Basically there are three methods of starting a strip—(1) by the end of the strip, (2) in the side of the strip, or (3) through the strip. However, any or all of these basic methods might be used on a single die.

The proper selection of starting technique sometimes constitutes a problem to the die engineer because of the variety of methods that may be employed. To further complicate his judgment, his decision must be governed by (1) the quantity of pieces to be made, (2) the type of material, (3) the shape of the part, (4) the cost of the material, (5) the thickness of material, (6) the style of stripper, (7) the length of the strips, (8) the style of press, and finally (9) the budget to which the die cost must be held.

The design features of the starting and stopping methods illustrated here are the most practical and efficient styles used by the modern stamping industries. However, it is my belief that, with the tremendous influx of new workers being trained in the metal stamping field, most of these stopping methods are wrongfully being relegated to obscurity.

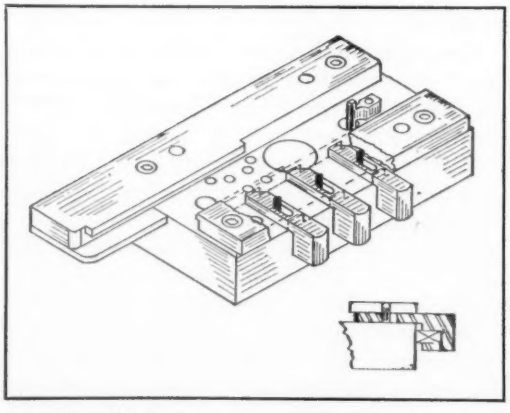
Recently I was privileged to witness the operations of one of the largest metal stamping shops in the country and was shocked to see the hodge-podge that existed in the starting of strips through the dies. The starting technique was left to the discretion of scores of tool and die shops that built the dies for this plant. Furnishing these tool and die shops with standard stops and stoppers, and insisting that they be used in dies built for this plant, would certainly simplify the maintenance and simplify the training of new operators.

In the 3-D views of the die illustrations shown, you will note that in some of these the material is fed into the dies from the right and some from the left. Those dies being fed from right to left are usually run in dieing machines and hand fed or roll fed presses.

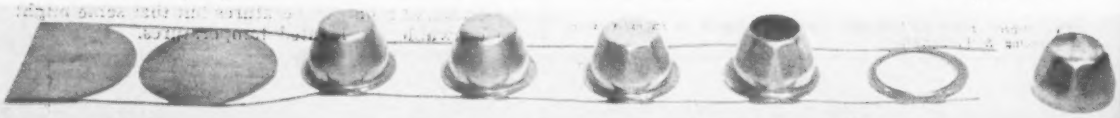
Those dies shown feeding from left to right are usually run in conventional presses converted to automatic machines by mounting mechanical or hitch feed devices. This type of feeding device is mounted on the left side of the press for the simplicity with which it receives its operational energy from the crank of the press.

Finger Stops

Finger stops are sometimes referred to as starting stops, and they are incorporated in a die to perform the function of stopping or locating the work strip to properly start it



through the die. No set rule can be made as to where the stops should be located, as each



die creates its individual problem. One rule must be followed and that is, once the first stop position is determined, the balance of the stops used throughout the die must be positioned in exactly the same pitch distance as the die layout. This increment of distance must be constant so as to insure proper piloting for accurate and consistent progression.

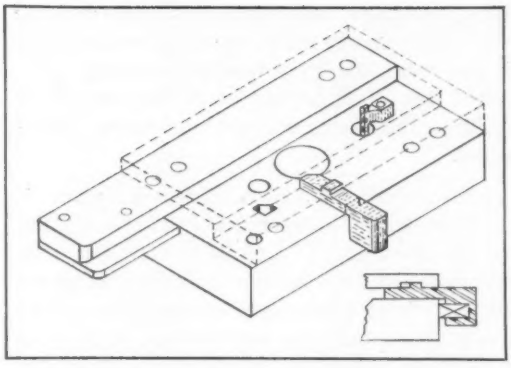
The success of an automatic die usually depends on the care and consideration given by the diemaker to the accessories that are necessary for the operator's convenience. Finger stops, because they are manually operated, are one of these accessories that must be designed to not only function properly but to be convenient and safe for the operator.

The most popular method of finger stop usage in progressive die operation, is to provide a finger stop for each station throughout the die. The strip is threaded through the die by depressing (or pushing in) the first finger stop and feeding the strip by hand until it contacts the finger stop, at which time a hit is made. It must be noted that the finger stop is continually depressed (held in against spring pressure) while the hit is made, so that loss of pitch will not occur. Thereafter, this cycle in continued throughout the balance of the stations or until a positive stop is reached.

When the stripper is mounted on the upper member of the die, the stock guides mounted on the lower member of the die are made with a stripping hood (used to strip the material from the pilots and to prevent the material from escaping its normal position). The finger stop openings are milled in the front stock giude, usually to the depth of the aforementioned hood. The finger stops are led in position by small dowels passing through the stock guide into a milled slot in the finger stops. The small spring recessed in the large body of the finger stop keeps the stop retracted when not in use.

Side Notch and Single Finger Stop

Often it is possible to employ the use of a single finger stop and still gage the starting of the work strip through quite a number of stations in a progressive die. This is done by cutting out a notch in the side of the strip, then pushing the finger stop into this notch. It is desirable to have the cutout notch parallel on one side and angular on the other. This is so the finger stop will enter into the notch cutout easily.



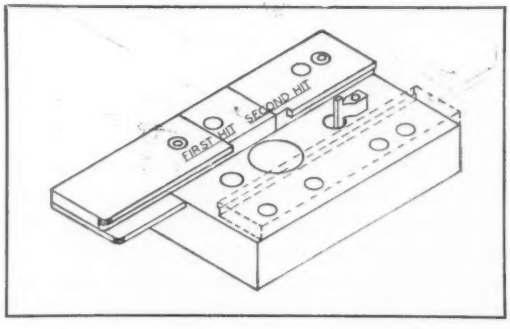
An additional advantage of using this type of stopping method is that the finger stop is used to push the work strip against the back guide to insure positive squaring of the material to the die layout. Naturally, this method should only be incorporated in a die where a great number of stations are involved and if the shape of the part permits its use.

This style of finger stop is used in a stripper with a combined stock guide. The knob on the top of the finger stop sets into a milled pocket in the stripper. This prevents the finger stop from being detached and also restricts the functional infeed of the stop.

Sight Stopping

Sight stopping is the simplest of all methods that are used in starting a work strip through a die. This is accomplished two ways, depending on the type of stripper that is mounted in the die.

1. Score marks. When the (pressure loaded) stripper is mounted on top of the die, the lower member permits unobscured vision of the strip as it enters and starts through the die.



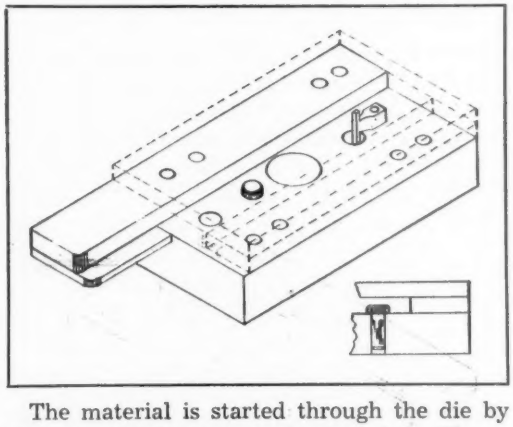
To insure the operator's starting of the strip, deep score marks are cut into the top and working faces of the stock guides and, in addition, are boldly stamped with the station fig-

ure. Naturally, this method should only be used when sturdy pilots are employed so that, in the event the strip was not properly positioned, the pilots would be strong enough to position the strip without damaging themselves.

2. Peepholes. When a fixed stripper is mounted on the lower member of the die, the strip is obscured. To be able to view the strip, openings (usually referred to as peepholes) are cut into the stripper spaced to the pitch of the layout. Generally the best method in starting the strip is to feed the strip to the edge of the peephole. The obscure limitations of viewing the strip can lead to disastrous results. For this reason, only the very experienced press operator should be placed on a job employing this style of stopping medium. Here again, sturdy pilots must be used to guarantee continuous performance.

Button Stop

A simple and effective type of stop used in the commercial stamping of light-gauge metals is the button stop. The button stop is located in the second station of the die block relative to the piercing hole location in the first station. The cap of the button stop, or the amount protruding above the die block, should be about ⅛" high; also, it should be slightly rounded off on the top edge and be a few thousands smaller in diameter than the piercing punch.

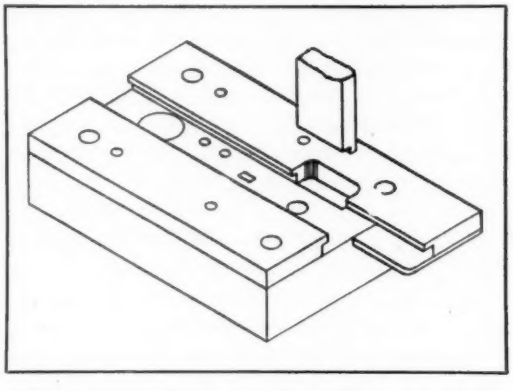


The material is started through the die by bumping the button on the first hit. Thereafter the strip is raised and advanced until it falls on the button stop. This feeding is continued until the automatic stopper is reached.

The stock guides are usually about ⅜" thick, and a fixed type stripper is employed. Because the punches raise the stock in order to strip, the press operator must be sure to bear pressure on the material so that it will advance immediately upon stripping. This is strictly a stop to be used in manual-fed automatic dies. The beginning and end of the strip produce a partial blank; however, in the blanking of light metals, no shearing of the cutting edges takes place.

Pitch Trimming

Pitch trimming offers the most versatile and efficient method of starting and stopping a work strip through the automatic progressive die, whether operated manually or mechanically fed. In this type of operation, a small amount of metal is trimmed from the width side of the work strip. The length of the metal trimmed is exactly the pitch distance.



The stock guide is made with two different widths of the stock channel. The width at the entrance accommodates the raw work strip and, beyond the pitch trimming punch, the channel width narrows down to confine the trimmed stock. The stock guide is precisely built to fit snugly against the trimming punch. This is very important, for this part of the stock guide performs the function of a bumper stop. The raw work strip engages this stop and, upon descent of the punch, the metal is cut with only two sides of the punch—the pitch distance and the stopping edge.

The punch must always be provided with an entrance heel, so that the pitch trimming punch enters into the die opening before cutting of the pitch takes place. This backing part of the punch must be closely fitted into the die opening to prevent any thrust when the cutting takes place. However, the backing corners of the punch should be well rounded off, and no time should be spent fitting them

to the die openings for they play no role in the operation. The die opening should have no taper; however, the die shoe should have an opening larger than the die.

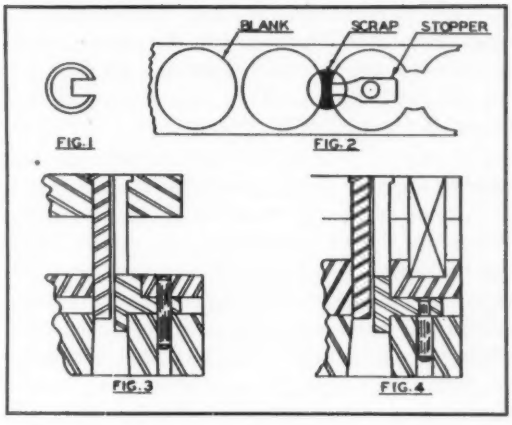
The average type of progressive die usually requires the pitch trimming of only one side of the material. There are occasions, however, when it is imperative that both sides of the material be pitch trimmed to insure trouble-free action. Always pitch trim both sides of the material when the material is exceptionally wide, in order to insure proper pitch motion as both cutout stops strike the bumper blocks. Whenever the trimmed sides of the material are the sides of the finished stamping, two sides of the stock should be pitch trimmed. Whenever the finished stamping requires two sides with exacting dimensions which shearing or slitting can't provide, two sides should be pitch trimmed. Whenever camber in the material would affect the function of the finished stamping, two sides are cut.

In a progressive die where a large number of stations are employed, and short strips of material are being used, and the sides of the material are used as carrying strips, two pitch cutters are desirable. One pitch is cut in the first station and the other is placed near or after the blank station, cutting on whatever side is desirable. In this manner, a die can be operated automatically even though hand fed.

It is very important to locate the pitch cutter in such a manner that, when the notched strip being threaded through the die reaches a cutoff station, the leading end of the strip will extend beyond the fragile cutoff station. This applies to the relation of the leading strip end to any weak punch or die, which in every case must make a full cut. This precaution is usually overlooked and results in sheared dies and punch breakage. It is better to lose the first blank because it is short than to continually maintain the sheared die.

Hatchet Type Stopper

A faultless, efficient and positive type stopper used in conjunction with a simple round cutoff punch (Fig. 1) provides one of the best mediums for trouble-free performance in automatic progressive die operation. The cutoff punch is grooved to clear the stopper. The simplicity of this device lends itself to be operated with equal ease in either hand fed or mechanically fed dieing equipment.



This method can be adapted with unqualified success in almost any type of progressive die, whether the blanks be round, square, or odd shaped. The only place it can't be used is in a die that produces very small blanks, for here the cutoff punch can't be reduced sufficiently to cut out enough of the scrap web to pass the largest part of the stopper. Its only fault is that, when using short strips of material, they must be run through their entire length; consequently, the last blank is usually a partial blank.

When coil strip stock is used in a manually operated progressive die in a pillar or arch type press, the performance of this style of stop and cutoff is at its best. On these presses, the operating foot pedal is in a comfortable position for the operator to pull on the outcoming scrap and at the same time depress the foot pedal. When short strips of stock are being used, it is not uncommon to have two people operate these style presses, one starting the strip while the other—pulling the scrap—continues automatic blanking through the balance of the strip.

Whenever this stopper and cutoff are used in open-gap type presses, always feed the stock from left to right so that the scrap comes out of the die on the side where the operating foot pedal is mounted. After the strip is started, the operator should stand on the right side of the press with the left foot depressing the foot pedal. In this position, the operator is less fatigued and decidedly more efficient.

Because the segment of the scrap web which is cut off (Fig. 2) is relatively close to the blank station, it is best not to permit this scrap to drop through the die unless an accurate chute

is made to separate the two. It is better to mill an inclined chute in the die shoe with a circular cutter, so that the scrap will slide on top of the bolster. This slug then can be blown to the rear of the press.

The upper and lower extensions of the hatchet stop perform a definite function and are important to the success of its operation. When used with a common flat plate fixed type stripper (Fig. 3), the top extension is keyed in the stripper and the lower extension sets in the scrap cutter die opening. This prevents any swiveling of the stop and also prevents the stock from burrowing above or below the stopper, as could occur if the extensions weren't there.

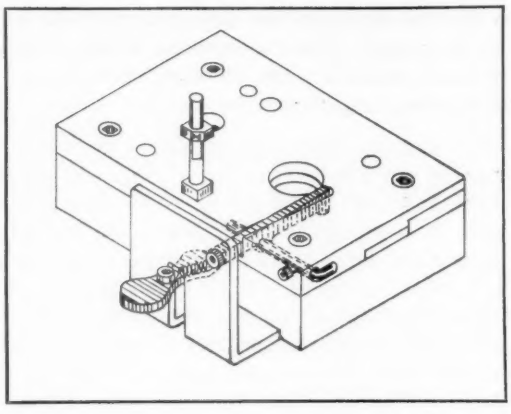
The size of the cutoff and the stopper can be enlarged to suit odd-shaped blanks. In the case of blanking a rectangular or square part which leaves a narrow web, it is best to move the stopper location closer to one side of the stock. This is to gain additional strength to prevent buckling of the scrap web.

This type of stopper was successfully hand fed in automatically blanking 0.010″ copper parts, 1½″ in diameter, with a 1/16″ scrap web. Naturally this stop only positions the strip in the die for proper piloting. Even the inexperienced operator, after a few practice hits, can efficiently operate a die fitted with this type of stop in an automatic manner.

When this stop is used on a die with a spring-loaded, movable, center step stripper (Fig. 4) and ledge type parallels, the ledges should be removed from the parallels beyond the blanking station. This is done so that the end of the strip can be removed from the die simply by lifting it up and over the stop. This prevents the possibility of making partial blanks.

Trigger Stop

When used in a progressive die, a trigger stop offers a satisfactory method of operating a die somewhat automatically by manual effort. In the event that short strips of material are to be used, it is almost inevitable that the last piece will be a partial blank if the strip was run through the die. However, with this type of stop, the operator can depress the trigger and remove the strip to avoid the danger of making a partial blank. A skilled press operator can butt one strip against another



and so prevent damage to the die and be able to operate in almost the manner of a continuous strip. During periods of metal shortages, this technique is often practiced.

It is worth mentioning here that, in running random length strips through a progressive die, the mechanical counter (which registers with each revolution of the crank) does not indicate the exact number of pieces produced but only indicates the hits made. To overcome this annoying problem, a rawhide thong should be connected to the arm of the counter and be long enough to reach the bolster. When starting a strip, the operator can be trained to pull down on the thongs and hold it down until the strip is carried through the progression and a blank has been made. This way the counter will register one digit, despite the number of hits made to complete the progression.

It is very important that the trigger be long enough so the operator can trip the trigger, whenever it is necessary, without the danger of being struck by the tripping pin mounted on the upper part of the die. Because of this dangerous condition, it is always necessary to install a guard to prevent the operator from ever being able to place a finger on the trigger directly under the trip pin. This requirement exists because, despite the care and accuracy that goes into making this stop, the actual functioning is supplied by the operator constantly bearing on the stock.

Despite the care and accuracy taken by the diemaker in building this type of stop, it is not foolproof; it is strictly a stop to be used in handfed dies. Even though the mechanical function of this trigger stop is built correctly, the success of its performance rests on the operator's ability in advancing the work strip the

instant it is stripped from the punches. The trigger stop operates with less trouble when the work strip is of heavier-gauge material. Primarily, this is due to the greater allowance of scrap between blanks, for it is upon this scrap that the engaging end of the stop rests permitting the advance of the work strip.

The trigger stop is customarily built into a fixed stripper having a combined stripper and stock guide. This provides a section of sufficient thickness for drilling the fulcrum pin hole without leaving a weak thin side wall. Also, the finger stops that are used can be more substantial. The fulcrum pin is usually made of drill rod with a hook on the end to facilitate removal. Because the fulcrum pin is a slip fit in the stock guide, it is retained by a set screw. The hole provided in the trigger arm for the fulcrum pin should be tapered from both ends so that the arm can swivel horizontally as well as vertically.

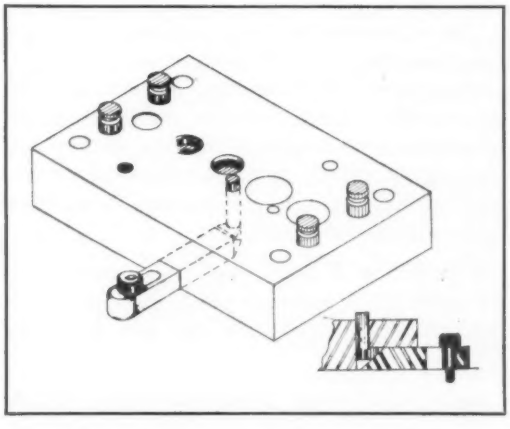
Springs of very peculiar shape are often used to operate the trigger. It is best, however, to standardize with a commercial type spring which can pull the outboard end of the trigger arm both upward and sideways. As the striking pin on the descending punch holder depresses the outer end of the trigger, the stop end is lifted from the blank opening. Spring tension pulls the arm sideways so that, as the ram ascends, the stop will come to rest on the scrap web. The strip may then be advanced, with the stop riding on the scrap until it falls into the next blank opening.

Cam-Operated Finger Stop

The usual practice of mounting pilots in an automatic progressive die is to mount them in the punch pad with the punches. A starting pilot mounted in the punch pad is subjected to abrasion during each and every hit that is made as it passes through the material. Consequently, this abrasion will either gall or reduce the size of the starting pilot until it no longer performs its precise function of accurately positioning the starting of the strip.

If the starting pilot hole in the die block is close to another die opening, it is inevitable that the die block will break when a mishit is made. This occurs because the bullet-shaped tip of the starting pilot will not pierce through the material but will actually try to draw the metal into the starting pilot hole in the die block.

Whenever these problems exist, it is wise to consider the use of a cam-operated finger stop (also referred to as a disappearing stop) in the starting of a work strip through an automatic die. This style of finger stop operates in the lower part of the die block. The angular end of the finger engages the angular end of the stop pin, forcing the stop pin to rise when the finger is depressed. The stripper mounted on the upper member of the die has no opening for this stop pin, so it pushes the stop pin down to the stock level when a hit is made.



Advancing the work strip until the pierced pilot hole drops over the raised stop pin, is repeated until the strip has been threaded through the die, at which time the press is engaged for automatic operation. The cam-operated finger stop pin, which is not being used during automatic operation, remains below the level of the die block.

Coming Soon: ***Another Urbas Article***

"AN AUTOMATIC DIE FOR DEEP DRAWN SHELLS"

Some aspects of MACHINING AND MACHINABILITY

by Francis W. Boulger
Division Chief
BATTELLE MEMORIAL INSTITUTE
Columbus, Ohio

AS MOST PEOPLE know, the term "Machining" refers to processes in which chips are removed from a workpiece in order to produce a particular article having the desired size, shape, and surface finish. There are many varieties of machining operations; turning will be mentioned most frequently in this article.

In turning, a single-point tool is fed into and along the length of a rotating workpiece in order to reduce its diameter. The cutting conditions—including cutting fluids, tool shape and tool material, cutting speed, depth of cut, feed, and work material—can be varied for any type of machining operation.

The machinist or the production manager usually defines "machinability" on the basis of production rates or tool life. Most metals can be machined, but they differ in machinability. Since the metallurgist cannot control the machining conditions, he cannot consider "machinability" a single simple property—like hardness or tensile strength.

Figure 1 is a chart used to illustrate that hardness is not necessarily a good indication of machinability.[1] Hardness can and does indicate tensile strength because both are simple properties. The relationship between hardness and machinability, however, is too general to be useful.

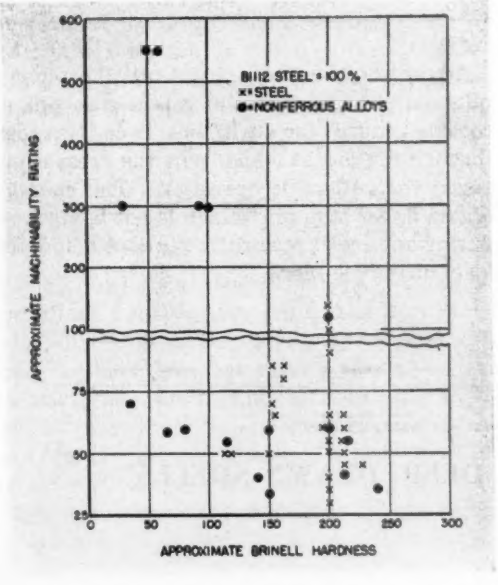


Fig. 1. Poor correlation between hardness and machinability ratings of various materials.[1]

This chart shows the hardness and the machinability ratings based on the cutting speeds used commercially for a number of steels and non-ferrous alloys. The chart shows that three non-ferrous alloys, having an equal machinability rating of 300, range from 25 to 100 Brinell hardness. The data for steels with a Brinell hardness of 200 are also interesting. At the same hardness, the machinability ratings range from 30 to 140.

This chart, developed from accepted reference book data, makes it obvious that the relationship between hardness and machinability is too general to be helpful.

Cutting Tests Measure Machinability

A cutting test is the best way to measure machinability. In order to be reliable, however, the test should simulate the operation which is of interest commercially. The machinability rating of a particular alloy varies with the type of machining operation.

Crampton has presented data to show that raising the copper content of a leaded brass improved the machinability.[2] The improvement caused by increasing the amount of copper from 58% to 62% was detected by milling, sawing, and drilling tests. However, the test ratings differed quantitatively. The milling test was most sensitive, and the drilling test was least sensitive to changes in composition.

Figure 2 shows results obtained by Cook and Davis in a similar study on the influence of copper content on the machinability of leaded brass.[3] The graph shows that the effects of metallurgical changes can even differ qualitatively. The saw-test data agree very closely with Crampton's in showing benefits from higher copper contents. The drill tests suggest the contrary conclusion.

Such discrepancies in machinability ratings are sometimes caused by conflicts between two functions in machining—cutting chips from the workpiece, and disposing of the chips. Although the chips could be removed easily from the alloys high in copper, they probably clogged the flutes of the drill. Because of such difficulties in chip disposal, materials that are markedly better in turning may not be outstanding in drilling.

Figure 3, based on data obtained by John Armour with a screw machine, also shows the importance of the machining operation.[4] The same steel was tested in three conditions of heat treatment, "A", "B", and "C". The life of different tools in the machine was affected by the heat treatment given the material. The tools, however, were not all affected equally.

Influence of Speed and Feed

Most operating men like to increase production. A metal that has better machinability should permit faster production rates. The production rate depends upon tool life. Usually the shop uses the fastest machining rate which will permit the tools to remove a specific amount of metal.

One way to increase the production rate is to increase the cutting speed, keeping other conditions constant. Data presented by Field and Stansbury shows that this shortens tool life.[5]

For example, if the tools have to be reground after 0.020" wear, it is possible to remove 27 cubic inches of cast iron at 1150 feet per minute, or 105 cu. in. at 510 fpm, or 270 cu. in. at 250 fpm, or 450 cu. in. at 210 fpm. In other words, doubling the rate of metal removal by increasing the speed decreases the useful cutting life by about 55%.

A better way of improving the rate of metal removal is to increase the feed. Heavier feeds increase the amount of metal that can be removed before a tool fails, except at very high speeds.

Field and Zlatin found that increasing the speed by 60% shortened the tool life of A8640 steel by one-third. On the other hand, doubling the feed, from 0.005 ipr to 0.010 ipr at either 300 or 500 fpm, increased the tool life by 150%.

Work done by Professor Trigger of the University of Illinois[6] showed that, in the machining of NE 9445 steel, doubling the speed raised the temperature at the chip-tool interface by about 200° F. The increase was about the same

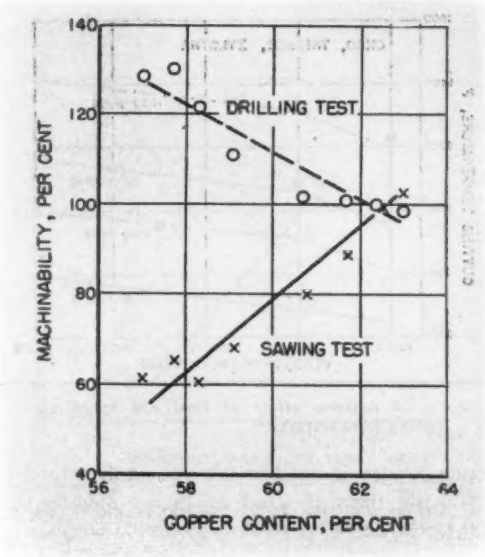


Fig. 2. Sensitivity of machinability ratings to testing methods.[3]

at either hardness level investigated—annealed to 185 BHN, and quenched and drawn to 400 BHN.

According to work by Harder, increasing the temperature from 1100° to 1300° F lowers the strength of high-speed steel from 400 to 200 Brinell. One might reason then that tools would fail sooner if the chip-tool interface temperature is higher.

Figure 4 shows some data obtained by Chao, Trigger, and Zylstra.[7] Their data permit the conclusion to be drawn that doubling the production rate by changing feed instead of speed results in only about one-third the increase in cutting temperature.

The square symbols on the chart show the cutting temperatures for various combinations of feed and speed which result in the same rate of metal removal. The extreme points show a difference of 160° F. The tool would last

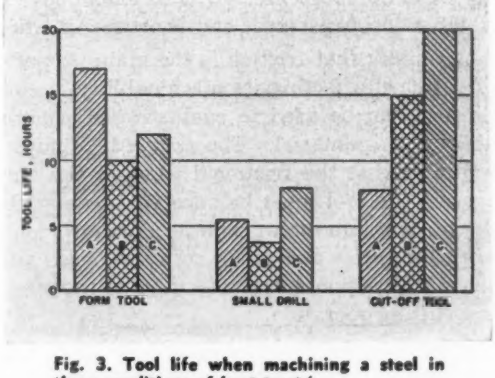


Fig. 3. Tool life when machining a steel in three conditions of heat-treat.[4]

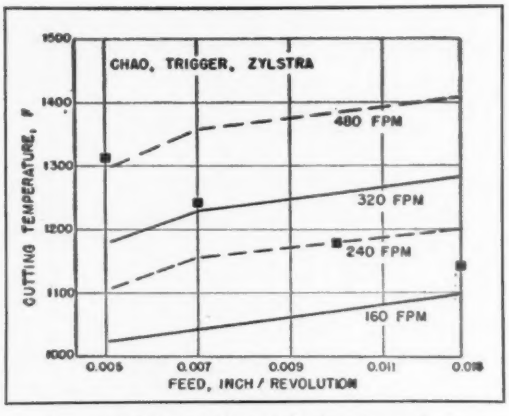


Fig. 4 Relative effect of feed and speed on cutting temperatures.[7]

much longer if used at 200 fpm and a feed of 0.013 ipr than if used at faster speeds and lighter feeds.

Sources of Operating Temperature

Figure 5 shows the simplest type of metal cutting—machining with a single-point tool. The chip is separated from the workpiece and thickened, strained, and work hardened as it slides across the tool. Part of the workpiece rubs against the end of the tool; the chip also rubs against the face of the tool. Heat is developed by all three actions. About 99% of the useful work expended in cutting is converted into heat. This can be shown by cutting in a calorimeter and comparing the energy put in as mechanical work to the energy liberated as heat.

Some of the heat goes into the chips and workpiece, but the amount of heat transferred to the tool is the most important.

I contend that the frictional properties of a metal, and its strength in the actual cutting operation, control machinability. It appears that almost half of the heat generated by friction at the chip-tool interface can be transferred to the tool. This softens the tool, lowers its abrasion resistance, and shortens tool life.

Assuming that friction is the main property of material affecting its machinability, a simple test can be used to evaluate the machinability of a material. The sketch in Figure 5 indicates that the frictional force of the chip against the tool must balance the force pushing the tool into the workpiece. Measurements of thrust forces and of the resulting feeds will show the frictional characteristics of the metal in a cutting operation.

A formula developed empirically from data obtained in turning tests, to show the relationship between the thrust force on a tool and the resultant feed, is as follows:

$$\text{Thrust} = \text{Constant} \times \sqrt{\text{Feed}}$$

$$(1)\ T = C\sqrt{f}$$

$$(2)\ f = \frac{T^2}{C^2}$$

This formula holds quite well for tests where speed, tool shape, and tool material are kept constant.

Determining Machinability Index

The Constant in the above formula varies for different materials, and is higher for a steel which is difficult to machine. This "C" value can be determined by measuring the thrust force developed in conventional lathes taking a known feed. Alternatively, the feed produced by a known thrust force can be measured.

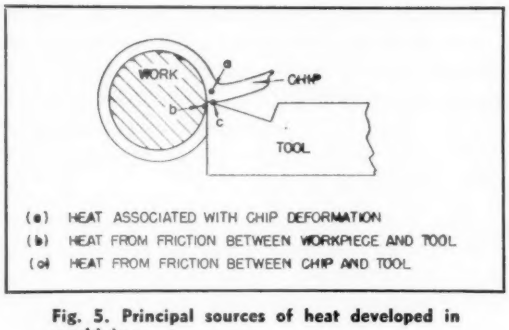


Fig. 5. Principal sources of heat developed in machining.

Measuring the feed developed by a known thrust force is much easier to do and is also more sensitive. We have used this principle in our work with a constant-pressure lathe.

The thrust or horizontal pressure on the tool is applied by hanging a weight on a cable connected through pulleys to the drum behind the hand wheel. The torque caused by the weight is transmitted to the carriage by a rack and pinion. The cable moving the carriage rotates a disk fitted to a pulley shaft or hub. The disk is so designed with lobes or cogs that a bell is rung every time the tool moves 0.1".

In making a test, the machinist records the reading from a spindle revolution counter every time the bell rings. Readings are taken over the full distance of a 2" cut made by the tool. Dividing the 0.1" increment of travel by the average of all the spindle revolution readings gives the average tool feed in inches per revolutions (ipr). The better machining steels cut with heavier feeds for the same tool pressure.

With proper control of the tool shape and

condition, thrust pressure, depth of cut, and surface speed of the work, the feed can vary with the machinability of the metal being tested. With ample power available for cutting, the feed is controlled by the friction of the chip sliding over the top face of the tool. Therefore, the feed varies with the frictional properties of the metal.

Ratings with the constant-pressure lathe are based on the assumption that the steel which cuts faster has the better machinability.

Test Method Checks Out

Once a laboratory test is available, the first thing to do is to find out if it is reliable. Figure 6 shows that the constant-pressure test rates various grades of steel in the proper order.

The chart shows average test ratings plotted against the cutting speeds used for machining the various grades commercially. The laboratory test ratings are averages for six or more lots of steel representing each grade.

The points fall very close to the trend line showing good agreement between the two methods of rating machinability, the only exception being C1144—a high-sulfur steel with about 0.50% carbon. Other information suggests that this steel can be machined satisfactorily at higher speeds than those usually recommended. Perhaps the laboratory rating is more reliable than the published value.

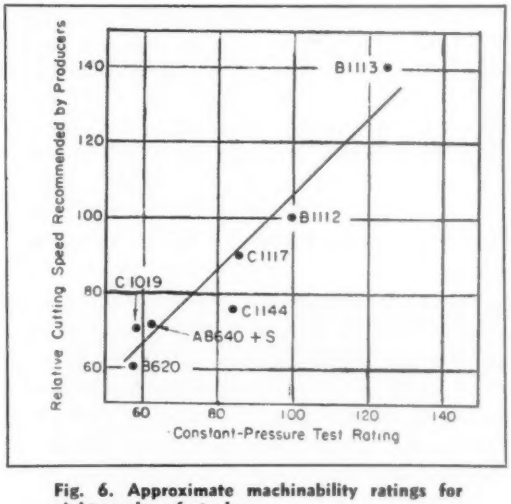


Fig. 6. Approximate machinability ratings for eight grades of steel.

Another way of establishing the reliability of a test is to compare the results with ratings obtained by an older laboratory method. Figure 7 compares ratings obtained in constant-pressure lathe tests and tool-life tests on the same materials. All points lie close to the trend line, showing that both testing methods rate the 10 materials in the same fashion.

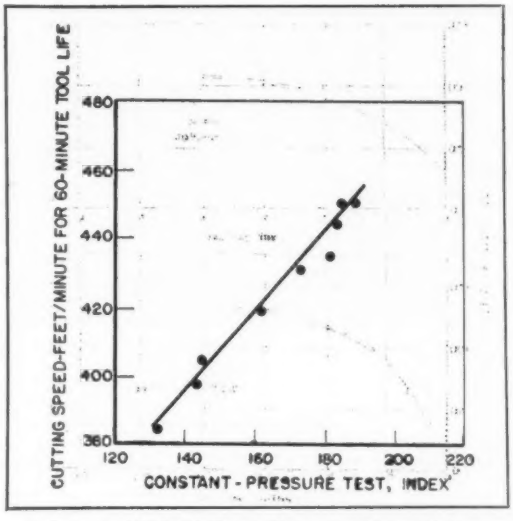


Fig. 7. Machinability ratings correlate against optimum cutting speeds based on tool life.

The tool-life tests required five days time and considerable amount of stock. The constant-pressure tests were made on bars 15" long in about two days. The latter method permitted worthwhile savings in time and stock.

Practically no tool wear occurs in the constant-pressure test, because the tools are reground frequently. Yet, the constant-pressure indexes check against the machinability ratings based on tool-life tests. This indicates that friction, which controls the feed in a constant-pressure test, also controls tool wear in tool breakdown tests.

Practical Uses of Test Method

Figure 8 illustrates the fact that adding sulfur to steel, or lead to brass or steel, improves machinability.[8] This is true because lead and sulfur act as lubricants and reduce friction. High sulfur steels are good-machining steels. Leaded steels, developed at Battelle, are the best free-cutting steels available commercially.

This graph indicates another important fact. The first additions of lead or sulfur are the most effective. At higher levels, the benefits are less pronounced.

B1112 and B1113 grades of free-cutting steels are widely used in mass-production shops. The latter grade contains more sulfur, 0.3%, usually has better machinability, and sells for a higher price. The frequency chart in Figure 9 shows that machinability ratings for individual samples of the same grade differ considerably.

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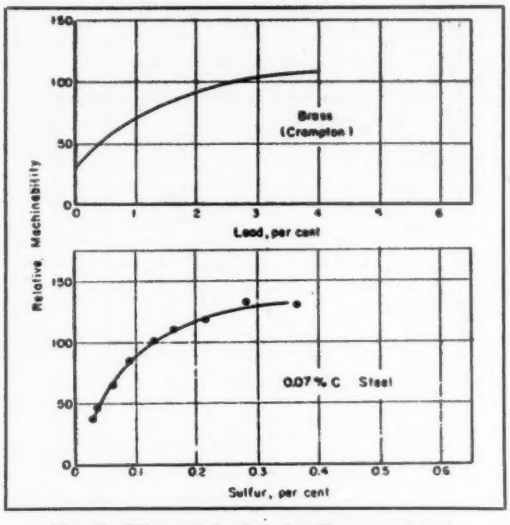


Fig. 8. Effect of lead and sulfur constituents on machinability.[8]

About 15% of the B1113 steels tested had poorer machinability than the average for the cheaper steel. Conversely, about 10% of the B1112 bars were as good or better than the average for the more expensive steel.

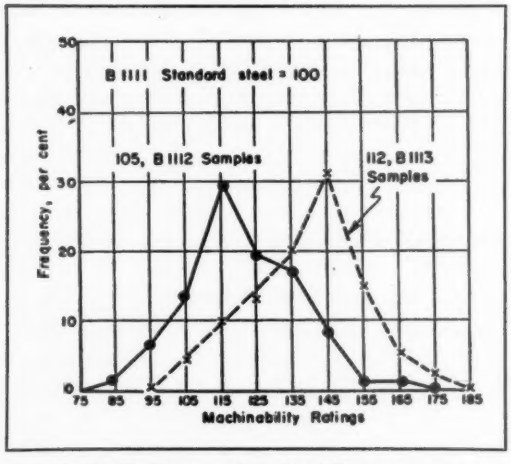


Fig. 9. Distribution of machinability ratings for hot-rolled Bessemer free-cutting steels.

Bars in a particular shipment can vary in machinability because segregation in the ingot causes differences in composition. In one ingot, the sulfur content was found to vary from 0.431% at one point to 0.262% at another point. Since the segregation pattern does not change in rolling, even small round bars can show large differences in composition within the same piece.

This explains why a bar may machine poorly at the surface but have good machinability near the center. It also explains why bars from the top and bottom of the same ingot do not necessarily perform identically in the same machine shop. It is only fair to point out, however, that segregation is less pronounced in steels which have been completely deoxidized. For this reason, killed steels exhibit more uniform machinability.

Influence of Microstructure

Figure 10 illustrates the results of a very successful research program on the machinability of free-cutting steels. The results of this investigation confirm the theory that friction is the most important factor controlling machinability.

These two micrographs show the sulfide inclusions in two bars from the same heat of steel. The chemical analyses show that they are identical in composition so far as normally specified elements are concerned. Everything usually analyzed for in Bessemer steel is identical except for a variation of 0.001% phosphorus.

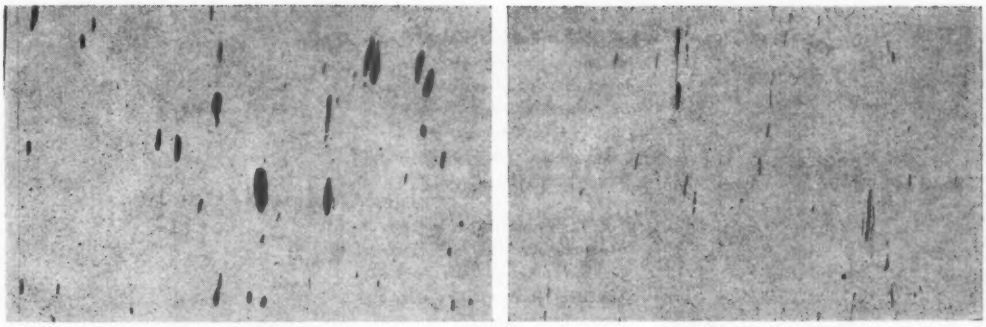
Nevertheless, the constant-pressure lathe test showed that the steel on the left had much better machinability. It cut 47% faster than the other steel in the laboratory test, for the same thrust force.

Metallographic examination showed that the sulfide inclusions were much larger in the steel at the left. This is surprising when we consider that both contained the same amount of sulfur and were rolled by the same practice.

Further investigation showed that the good steel, the one with the big sulfides, contained only 0.002% silicon. The one at the right contained 0.032% silicon. The ratio is 16:1, even though both silicon contents are below 0.04%, or four parts in ten thousand. Silicon content is not mentioned in specifications for this steel because it is always low and has no effect on most properties.

After this simple laboratory test had turned up unexpected information, it was simple to re-examine the steels used for the earlier frequency charts. Those materials, also, showed that large sulfides and low silicon contents correlated with better machinability ratings on Bessemer steels.

A patent on an improved free-cutting steel was secured on the basis of this work. This proprietary steel containing comparatively large sulfide inclusions has been marketed for several years. Experience in many machine shops show that it permits faster production rates at equal or longer tool life than steels



0.07%	Carbon	0.07%
0.94%	Manganese	0.94%
0.094%	Phosphorus	0.093%
0.200%	Sulfur	0.200%
150	Machinability Rating	106

Fig. 10. Larger sulfide inclusions, left, are accompanied by better machinability.

previously considered typical of this grade.

In addition to composition and inclusions, microstructure can markedly affect the machinability of materials. Figure 11 shows the structure of a particular C1045 steel in the hot-rolled condition (left) and after heating to 1600° F and cooling in air (right). The heat treatment refined the grain size and changed the distribution of the ferrite or white phase.

Tests showed that this change in microstructure was reflected by a change in machinability rating. Even though the strength and hardness and composition remained constant, the normalized steel had a poorer rating.

In carbon steels containing about 0.45% carbon, a medium-coarse grain size and as much ferrite as possible is usually desirable.

Summary

From our experience, certain conclusions can be drawn. Machinability has to be evaluated by metal-cutting tests. Tensile strength and hardness data can be misleading because they do not necessarily reflect properties at high speeds and elevated temperatures.

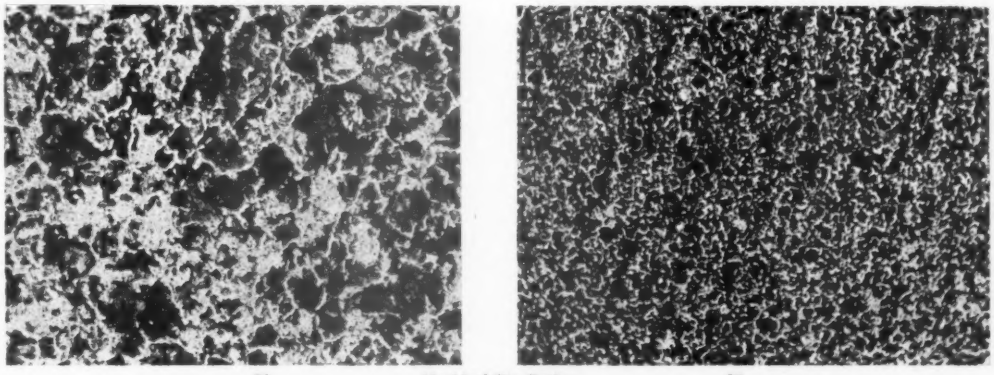
Machinability tests should simulate the operation of interest commercially; lathe tests do not necessarily predict how a material will drill.

Frictional characteristics of materials are the properties of greatest importance during machining. Strength and friction at the operating temperature together determine the machinability of a material.

Simple constant-pressure tests are useful and reliable. They can detect the effect of microstructure and composition on machinability. The fact that constant-pressure test data correlate with tool life tests and observations in machine shops proves friction is a controlling factor in machinability. The fact that a good correlation is obtained for laboratory ratings also indicates that abrasive inclusions have little or no influence on machinability.

Credits

1. Chart adapted from data presented in METALS HANDBOOK, published by the American Society for Metals.
2. D. K. Crampton, "Machinability of Copper Alloys", METAL PROGRESS (August, 1944).
3. M. Cook and E. Davis, "Free-Turning Brass", JOURNAL, INSTITUTE OF METALS (1939).
4. Chart adapted from data presented by J. D. Armour, "Metallurgy and Machinability of Steels", an article included in the book MACHINING —THEORY AND PRACTICE, published by the American Society for Metals (1950).
5. M. Field and E. E. Stansbury, "Effect of Microstructure on Machinability of Cast Irons", TRANSACTIONS OF ASME (August, 1947).
6. B. T. Chao and K. J. Trigger, "Cutting Temperatures and Metal-Cutting Phenomena", TRANSACTIONS OF ASME (August, 1951).
7. Chart adapted from data presented by B. T. Chao, K. J. Trigger, and L. B. Zylstra, "Thermophysical Aspects of Metal Cutting", Paper No. 51-A-41, presented before ASME, November 25-30, 1951.
8. Upper Chart. D. K. Crampton, "Machinability of Copper Alloys". METAL PROGRESS (August, 1944).



58	Machinability Rating	51

Fig. 11. In hot-rolled stock, extreme refinement of grain size by heat treatment, right, resulted in poor machinability.

Fig. 1. (left) The thread measuring wire fits snugly over the thread form. Merely pinching the lever-like ends of the coil permits instantaneous positioning and removal of the wire.

Fig. 2. (right) With the self-holding gage wire in position on the plug or part to be checked, it is easy to use a micrometer for "over the wire" measurements.

A Simplified Approach to the Gaging of Screw Threads

THE INSPECTION of finished components presents little difficulty for the inspector when accurate and reliable means of ascertaining the actual sizes are available.

Linear measurements can be measured accurately to millionths if necessary; the hardness, strength and surface finish, can also be checked to a high degree of accuracy, because there are instruments capable of assisting the inspector in making his decision as to whether the component meets the specification.

One of the most common and most difficult inspection problems is that of screw threads. Millions of parts are rejected annually because they fail to pass the gages commonly in use. Very often the parts are re-checked on another gage and accepted due to differences in design, gage tolerances or setting variations. Why is this? The answer to this question can be stated quite simply.

Elements Affecting Interchangeability

Normally, the inspection of components consists of checking the various dimensions, one at a time, by means of fixed or indicating gages. Any variation from the specified tolerances can then be instantly located. The screw thread, however, has as many as nine varying elements, any one of which, if oversize, can defeat interchangeability. The most important of these are:

1) Major or Outside Diameter
2) Minor or Root Diameter
3) Pitch or Effective Diameter
4) Angle of Thread
5) Lead or Pitch of Thread

These are the main elements of a thread upon which there are definite tolerances. There are also other troubles which can affect interchangeability even if the above elements are within tolerances, the most common being out-of-roundness and drunkenness, that is, the thread does not run true with the axis.

Essential Gage Requirements

It is obvious economically impossible to check each individual element so gages have been specified to check the two essential features of a screw thread.

1) The screw must assemble in a nut or tapped hole of standard or basic size.

2) In order to assemble the screw, the size should not be reduced below the minimum requirements.

The National Bureau of Standards and other authorities on screw threads recommend that "GO" gages should check as many elements as possible. The "NO GO" gage, however,

by Eric G. Gabbey
O-VEE GAUGE COMPANY
Los Angeles, California
Managing Director,
O-VEE SPRING GAUGES, LTD.
London, England

Fig. 3. (left) The O-VEE comparator has been developed for such fast operations as the gaging of threaded parts in step with production.

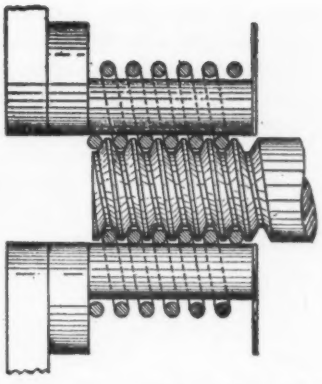


Fig. 4. (right) This detail shows the relationship between the piece being checked and the thread measuring coils which constitute the comparator anvils.

should only check one, the pitch diameter, for this element is the most important as it governs the strength of the screw thread.

Advantages and Disadvantages of Ring and Snap Gages

A "GO" ring gage is generally considered to be the best means of ensuring interchangeability as this represents a standard threaded hole of basic size. However, it has the disadvantage that it wears rather rapidly. "GO" caliper gages are not so efficient because they will not detect an out-of-round condition, but they enjoy great popularity as they are faster in operation.

For the "NO GO" or minimum size, these gages in general use have a number of disadvantages. A "NO GO" ring gage may pass an undersized thread under any of the following conditions:

1) If the first thread is ragged or bruised.
2) If there is lead error.
3 If the part is out-of-round.

The "NO GO" caliper gage is, in this case, more efficient, for the "NO GO" rolls are reduced in length to check only one pitch of the thread. This means that any lead variation cannot affect the user's judgment as to whether the thread is thin or undersize.

Lead Error

Inspectors have long been baffled by the sometimes confusing indication of ring and snap gages. It has been common practice to blame this on the only element which is difficult to isolate—the lead. Lead error can only be determined by the use of a lead checking device or an optical comparator adapted to check lead. To illustrate, consider the following cases:

1) Screw No. 1 is slightly under basic size in all elements and has a lead error.

2) Screw No. 2 is slightly under the low limit but also has a lead error.

If we insert Screw No. 1 in the "GO" ring gage, it will start binding after it has been inserted one or two threads. To anyone not acquainted with the screw as we are, it would be rejected as oversize on one element, although it could not be stated which. The "GO" snap gage would give the same reaction. Some manufacturers claim that daylight can be seen where there is a difference in lead, but under workshop conditions this is impossible as a difference of .001″ would be considered an extremely bad lead error.

Screw No. 2, if inserted in the "NO GO" ring gage should be rejected, but the lead error will cause the screw to feel tight in the gage, causing the inspector to incorrectly judge the screw as above the low limit. The caliper gage here will correctly reject the part as the lead error will not affect the only one pitch of the thread. These remarks on the main differences of the two most commonly used gages are generally well known, but the fact remains that whichever is used there is still considerable difference between any two gages even of the same type.

Gage Variations

A meeting of the Interdepartmental Screw Thread Committee was held in July 1952, at the National Bureau of Standards to discuss these variations, and to provide a referee method of settling any dispute where two gages differ. Most disputes center around the "NO GO" gage, for if a part is undersize it cannot be salvaged. As has been stated earlier, the National Bureau of Standards recommends that the "NO GO" gage should measure

pitch diameter only, but in actual fact conventional gages do not measure the true pitch diameter but only an approximation, the accuracy depending upon the variations of the several elements.

It was disclosed, by accurate charting, that the variations in size of any two "NO GO" ring gages could be as much as one-fourth of the working tolerance due to the accumulated gage and setting plug tolerances. Although the "NO GO" snap gage variation was shown to be considerably less, in actual use the variation will be much more owing to the human element coming into the picture. No two setters will set a gage alike and similarly no two inspectors will pass similar judgment on a component which is a borderline case.

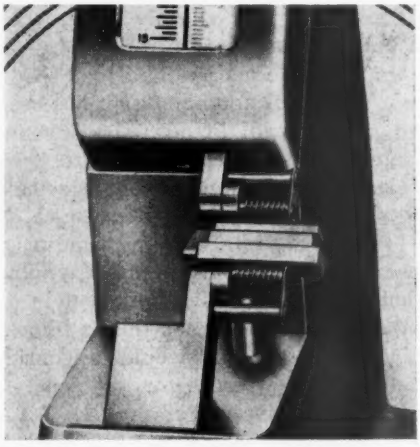


Fig. 5. Standard, readily available, gage blocks rather than master setting plugs are used to set the comparator to any screw size.

Measuring Pitch Diameter by the Wire Method

As previously stated, the recommended practice for "NO GO" gages is to measure the pitch diameter only and that the effects of lead and angle errors should not effect the accuracy of this measurement. The accepted method of measuring pitch diameter is by means of the 3-wire system and this is mostly used when measuring thread plug gages, where accuracy is of paramount importance. It is however very slow and cumbersome and involves the use of tables, calculations, etc. For this reason the 3-wire system has not been used as a production check except as a referee method in cases of dispute.

Simplified Approach to Gaging Screw Threads

Because of the variations in the several elements of the screw thread and the complicated literature describing all the possible errors, inspectors and others engaged in the production of screwed components often become quite confused.

The gaging of screw threads is extremely simple if all the complications of the various elements are left to the manufacturer of gages; these are his problems. Errors in all elements are always present. Providing they do not interfere with the function of the screw, they can be ignored. It should be remembered that a screw thread, to be acceptable, must conform to two simple checks:

1) It must assemble in a standard threaded hole.

2) The size must not be reduced below the minimum specified.

Item 1 is best taken care of with a "GO" ring gage. If any one of the elements is oversized, the part will be rejected.

Item 2 cannot be accurately checked with a "NO GO" ring gage for the reasons already stated. The "NO GO" snap gage is better, but still not accurate enough.

The 3-wire method will give the most accurate determination of the low limit. From the above remarks, it will be seen that pitch diameter is the most important element of a screw thread. It should also be remembered that the tolerance of a screw is specified on pitch diameter.

The O-VEE Method

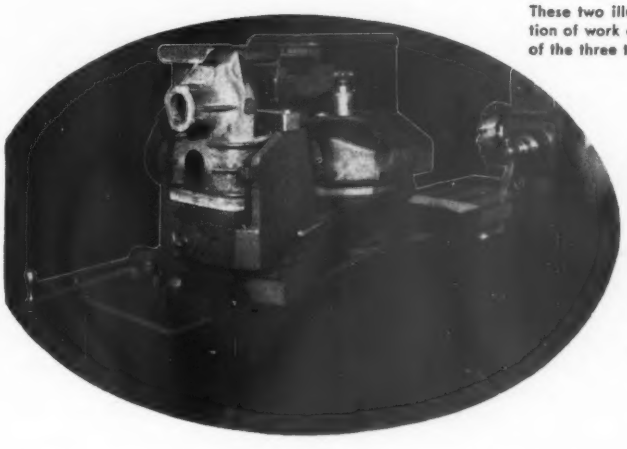
To meet the need for a rapid means of determining the pitch diameter of screw threads, the O-VEE gage and the O-VEE comparator were developed. The O-VEE gage, Figure 1, is a simplification of the three-wire method, and consists of a single wire of the correct size to contact the pitch diameter, wound into a coil. This can be expanded by pressing one end, which is formed into a lever, to admit the screw being checked. When the lever is released, the O-VEE gage will grip the thread firmly enabling the user to make the usual micrometer measurements "over the wires", Figure 2. There is no complicated arithmetic necessary, for the high and low limits are engraved on the data plate attached to the gage. All that is necessary is that the micrometer reading be between these limits. O-VEE gages are made in any of the regular classes of fit, including the new Unified Standards and can also be supplied to special requirements.

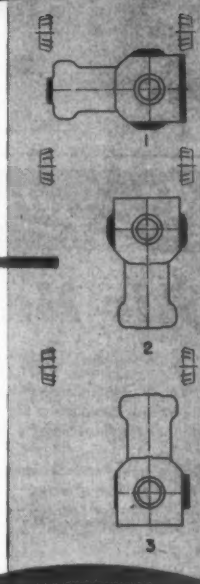
For faster operation, the O-VEE comparator, Figure 3, was developed. In this case the pitch diameter is checked by positioning the screw between a pair of helical coils of the correct size wire to suit the thread being measured, Figure 4. This instrument is supplied with a

. . . *Continued on page 114*

This Ingenious Hydromatic Setup Combines 2 operations in one

These two illustrations show the position of work and index fixture for two of the three trips past the cutters.

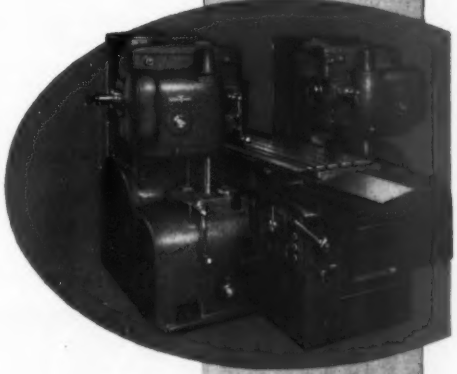




Drawing of part and sequence of feed cycles for milling four surfaces in one setting. Heavy lines indicate milled surfaces.

Part name	Gear housing
Material	Cast iron
Operation	Mill four surfaces
Depth of cut	3/16"
Feed	16" per minute
Cutting speed	223 feet per minute
Production	5 per hour

You always come out ahead when machining operations are combined. In this example, four surfaces are milled in one setting of the work, resulting in a 50% saving in setup time and handling time for a builder of agricultural machinery. ¶To gain the advantage of two cutter spindles working together, Cincinnati Application Engineers assigned the job to a duplex style CINCINNATI Hydromatic Milling Machine. One fixture and one handling of the work takes care of what ordinarily would be considered two operations. The fixture has three index positions. (See explanatory drawings.) With sintered carbide face mills and a feed cycle which cuts in both directions of table traverse, an excellent finish is produced at low cost. ¶CINCINNATI Hydromatics offer several advantages for work of this type: automatic table feed cycles, one-way or two-way feed; seven ranges of spindle speeds with plenty of power for high speed steel and sintered carbide cutters; standard and complementary units to provide special machine features at low cost. ¶For complete information write for catalog No. M-1670-1.



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CIRCLE INFORM-A-GRAM KEY NO. 60

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Talk of the Month

★ ★ ★ ★ ★ ★ ★ ★

ENGINEERING AMERICA'S FUTURE*

by Gwilym A. Price
President
WESTINGHOUSE ELECTRIC CORPORATION
Pittsburgh, Pennsylvania

AS PART OF MY HOMEWORK for this occasion, I have done a bit of reading in the history of your organization and have looked through a few of the volumes of ASME proceedings. I finished this research with mixed emotions. I was deeply impressed by the truly great contribution the ASME has made through nearly three-quarters of a century in carrying out one of the objectives that was laid down in the founding meeting in 1880—that is, "the collection and diffusion of knowledge among men." At the same time, I became more than a little embarrassed at the prospect of my name being added to the list of distinguished gentlemen who have addressed this body.

I was relieved, therefore, to remember that one of those eminent men was an old friend of ours in Pittsburgh. He became one of your first honorary members, he served as your president, and in his presidential address he told the story of one of the great discoveries for which he was famous. I consider it a special privilege to address the society over which George Westinghouse once presided.

Nineteen hundred and ten, the year George Westinghouse served you, is now rated among economists and historians as one of the most significant of our history. It was important to me because I was about to leave high school to take a full-time job.

. . . *Continued on page 64*

*From a talk presented at the 1953 Annual Dinner of the American Society of Mechanical Engineers, and reprinted through courtesy of the ASME.

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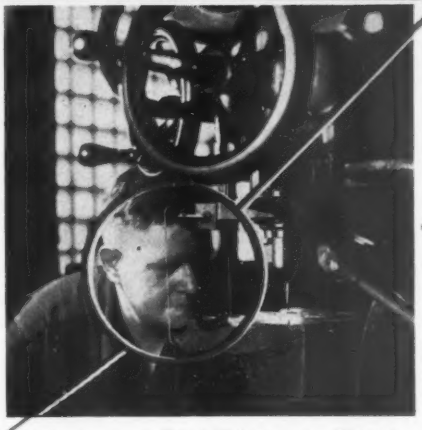

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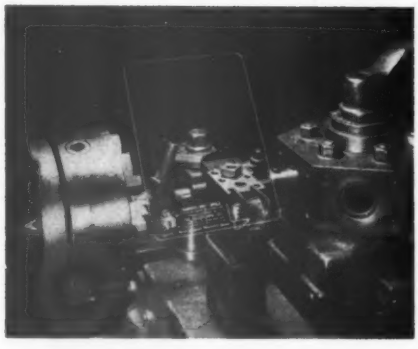

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This brochure tells of a dependable plastic for tooling requirements called Ren-ite. The booklet illustrates such uses as for Keller models, duplications, spotting, welding and checking. It is a product of Ren-ite Plastics, Inc.
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DISC GRINDERS

Single Spindle Disc grinders and accessories made by the Besly-Welles Corp. are described in this interesting catalog. A clear picture of the range of sizes in which these grinders are built is presented.
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POWER PRESSES

This catalog gives full information on the complete line of Press-Rite Presses from 5 to 85 tons capacity. The illustrated brochure is available from the Sales Service Machine Co.
Circle Inform-A-Gram No. E9.

SMALL HOLE DRILLING

This bulletin is on the Hamilton Varimatic, super sensitive, small hole drilling machine. Included in the very informative folder, put out by the Hamilton Tool Co., are detailed descriptions of the 20 main parts of the machine.
Circle Inform-A-Gram No. E10.

TAPS

High speed, ground from solid Tecni-Taps made by the Charles L. Jarvis Co., are illustrated and described in this booklet. A price list, dimensions and specifications also are included.
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MILLING PRODUCTION

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Three types of honing tools and several types of honing machines are illustrated and described in the Barnes Drill Co. Bulletin No. 500. A section also is devoted to Barnesdril plugmatic bore-to-bore sizing.
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CARBIDE TOOLS

This new complete carbide catalog is offered by Chicago-Latrobe. It contains 24 pages of 40 different high quality carbide tipped tools. It also has several pages of engineering data plus a carbide grades chart.
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OPTICAL PYROMETRY

An optical pyrometer is a device for measuring the temperature of a hot body from a determination of the brightness of the surface of the object under measurement. The Pyrometer Instrument Co., Inc., has a catalog with complete information.
Circle Inform-A-Gram No. E16.

J. R. Fitzsimmons, Founder of Die Supply Company, discusses the features of a DIECO Die Set with J. H. Tredinnick, Bliss Executive Vice President; Warren Fitzsimmons, Plant Manager; and sales engineers at a recent meeting at the Company's plant in Cleveland.*

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* Left to right: J. R. Fitzsimmons; Tredinnick; Warren Fitzsimmons; Ed Brumagin, Ed Buck and Bob Gayner (Cleveland); Bill Powell (Dayton); Donald Flynn (Buffalo); Louis Taber, Customer Service (Cleveland) and John Sacash, spring application engineer (Cleveland).

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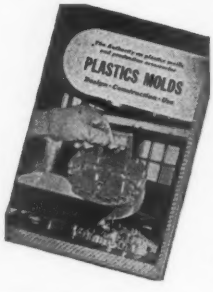

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. . . Month's Talk, from page 60

The Harvard economist, Professor Leontief, points out that it was in 1910 that a real turning point in this country's economic and social development occurred. That was the year, he says, when the last wave of immigration reached its crest; the year, too, when our rural population began to decline in absolute terms. In 1910, the amount of energy generated by the labor of men and animals reached its peak, and machines increasingly took over. One year earlier, the model-T Ford started to roll off the first continuous production line, and the result was felt almost immediately in shorter working hours. This shift to mass production by machine marked the beginning of what has been called the most sweeping revolution man has ever known.

Our rapid industrialization was made possible by a combination of favorable factors rather than by any one cause; but certainly the application of engineering principles to business and industry was the heart of the formula.

I do not propose to dwell, however, on the accomplishments of the past 43 years. I am concerned, rather, with the problems of the present and the needs of the future.

Those problems are not simple and those needs are not trivial. In this century, we have found remedies for evils that have cursed mankind for thousands of years, but we have generated new evils that demand new solutions. There are aspects of American life today that must rouse any order-loving engineer to anger and make any citizen of our land blush with shame. For example:

The president of the American Bar Association last March called us "the most lawless people in the world." An associate justice of the U. S. Supreme Court one month ago declared that the nation is plagued "with unprecedented juvenile delinquency, gangsterism and shocking crimes followed only by long-delayed punishment or none."

Having last year killed our millionth human being in traffic accidents, we are now working on the second million at the rate of almost 40,000 deaths annually.

. . . *Continued on page 66*

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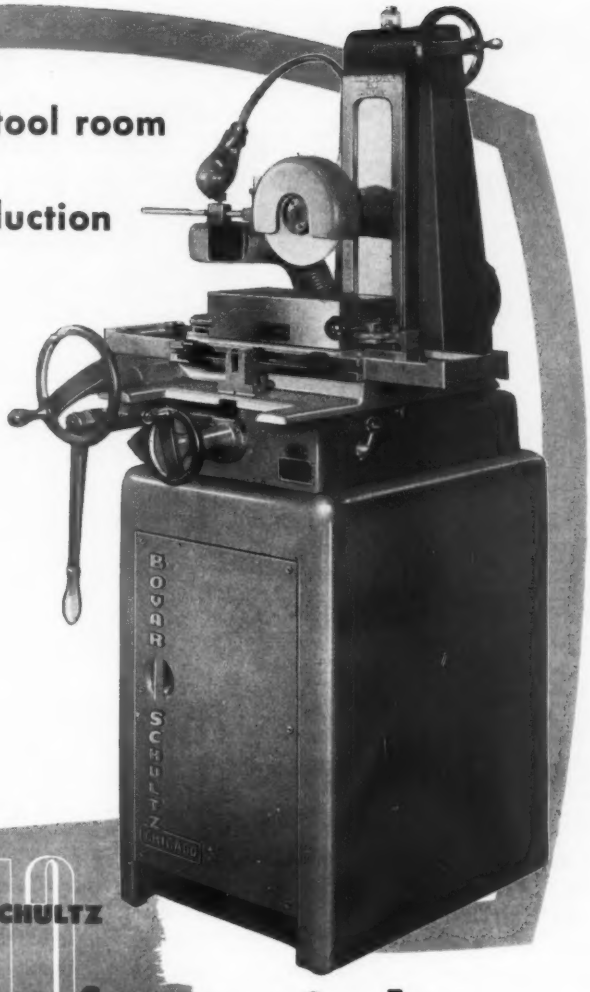
Precision for production



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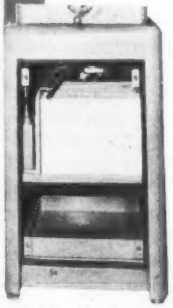
DIAMOND DRESSER AND DIAMOND. A sturdy fixture presenting a generous surface to magnetic chuck.



BOYAR-SCHULTZ DUST COLLECTOR FOR No. 6-12 GRINDER

Furnished as optional equipment for No. 6-12 Surface Grinder. Unit is fitted into a specially designed stand and made expressly for this grinder. With it the grinder requires no more floor space. With this Dust Collector, the Surface Grinder is operated entirely independent of a central collecting system. The entire assembly may be easily and quickly removed for complete cleaning when necessary.

BOYAR-SCHULTZ ☆ 6-12 surface grinder

A PRECISION Machine Tool specially designed to provide the close tolerance performance usually expected only from larger and more costly grinders.

Boyar-Schultz No. 6-12 Surface Grinder has shown repeatedly that it is fully capable of handling a large part of the daily work that is ordinarily done only on larger machines.

Because the first cost is so low, and the quality of performance is so high, it is most economical to place several No. 6-12 Surface Grinders at strategic positions in your tool room, where they are quickly available.

Many users tell us they are able to obtain flatness, horizontal and vertical tolerances with this grinder, that compare with any other precision surface grinder, regardless of size.

This excellent performance is the net result of unusually sturdy design, fine materials and the efforts of craftsmen who themselves know what a precision machine tool must do.

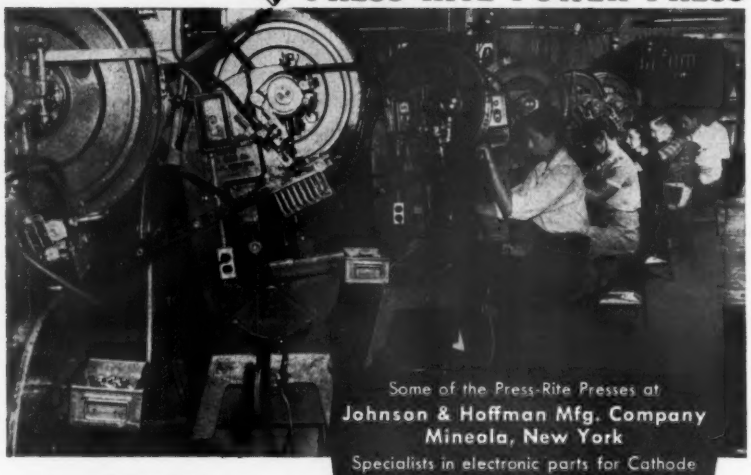
Big Machine Performance—Small Machine Cost!

BOYAR-SCHULTZ CORPORATION

2112 Walnut Street, Dept. TP • Chicago 12, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 65

130,000,000 pieces
produced on one PRESS-RITE POWER PRESS



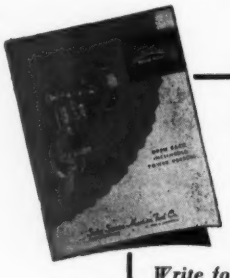
Some of the Press-Rite Presses at
Johnson & Hoffman Mfg. Company
Mineola, New York
Specialists in electronic parts for Cathode Ray Radar and Television Picture Tubes.

PRESS-RITE

POWER PRESS SETS PRODUCTION RECORD!

In just *four* years, one PRESS-RITE Power Press has produced 130,000,000 pieces with a minimum of maintenance . . . and it is still going strong each day. The excellent performance of this press resulted in adding 35 more PRESS-RITE Presses from 5 to 30 ton capacity. The material used runs from .002 to .030 thick with ≠ .00025 tolerance and includes nickel, stainless steel, aluminum, brass, copper, Beryllium copper, titanium, kovar, rodar, tantalum, nickel silver and precious metals. Strip is fed into the press with a tolerance of ≠ .001.

Results such as these can be yours too! You can *increase* your production and *lower* your costs at the same time with PRESS-RITE Presses.



FREE Engineering Service

Send us a blue print or details of your press problems. Our experienced engineers will gladly send you their recommendations on the best method for handling and equipment required.

Write for Free bulletin No. P552 describing Press-Rite Presses from 5 to 85 tons capacity.

Sales Service Machine Tool Co. SSMT

PRESS RITE PRESSES • SHAPE RITE SHAPERS • KELLER POWER HACK SAWS

2363 UNIVERSITY AVENUE • ST. PAUL 4, MINNESOTA

CIRCLE INFORM-A-GRAM KEY NO. 66

. . . month's Talk, from page 64

American industry has engaged in a maximum effort to reduce its accident rate, but the great gains here have been virtually cancelled out by this senseless and avoidable slaughter.

We have two and a half million illiterates in this country. Our children are suffering from a shortage both of public schools and of teachers. Some of the schools in daily use within a mile or two of this hotel are 75 years old.

Mental illness is fast becoming the major national health problem. During World War II, we rejected or discharged two million men for personality or psychiatric reasons.

Our cities are littered with rubbish and still spotted with slums that are not fit for people to live and grow up in. Our national standard of housing is far below our over-all standard of living. Most of our cities, and all the large ones, are choked with traffic congestion. A recent study estimated the yearly cost of traffic jams in this one city at more than a billion dollars.

Our industrial productive machine has been expanded enormously in the past dozen years, and we take great pride in our physical plant. And yet economists point out that we have merely caught up with the ground we lost in the depression.

Well, what do we do about it?

Part of the answer is simple. We do more of what we have been doing in the past, and we do it faster and much more efficiently. Wherever technology is concerned — wherever problems are subject to physical solutions —we are the masters of our fate. We can put up the schools we need, clear out slums, build better roads, perfect our industrial machine. We can accomplish these things as we have overcome even graver problems in the past —by the application of engineering principles to business and industry. There is almost nothing that we cannot do, if we bend our national will to doing it.

I hesitate to state the obvious; but the first requirement of such a national effort in engineering is—engineers. The deficit is now critical. Unfortunately, we shall have to live with this shortage for years to come.

. . . *Continued on page 107*

SPINDLES REPAIRED

Whitnon ● Heald ● Brown and Sharpe ● Excello ● Parker Pope ● Rivett ● Dumore ● Bryant and many other makes, including Hycycle and Air Driven High Speed Grinders.

Modern, air-conditioned workshop, complete facilities for handling the most delicate and expensive spindles. All parts inspected and checked to high precision tolerances. All worn parts replaced. Where there is a difficult spindle problem, one of our fieldmen will analyze your problem and make recommendations to overcome unsatisfactory performance.

New, Super-precision, Preloaded WHITNON Spindles in all Popular Sizes Immediately Available from Stock.

Your Spindles Returned SERVICED or REPAIRED in a matter of Hours . . . Not Weeks

INDIANA: Ft. Wayne • Indianapolis • Lafayette • Muncie • Terre Haute
NEW JERSEY: Camden • **OHIO:** Akron • Canton • Cincinnati • Cleveland Columbus • Dayton • Elyria • Hamilton • Lima • Mansfield • Toledo • Youngstown Zanesville • **PENNSYLVANIA:** Erie • Johnstown • Philadelphia • Pittsburgh Reading • York • **WEST VIRGINIA:** Charleston • Huntington • Wheeling

BEARINGS, Inc., 3634 Euclid Ave., Cleveland 15, O.

MEMBER AFBDA

Gentlemen:

I would like further information on your Spindle Repair service ☐

Send me your new spindle repair booklet. ☐

Name ..... Title .....

Company .....

Address .....

City ..... Zone ..... State .....

CIRCLE INFORM-A-GRAM KEY NO. 67

ILLUMINATED MAGNIFIER

for inspection and assembly

Operator has both hands free. Complete unit including adjustable stand, with precision wide-field lens designed for use at "normal" working distance from eyes. $13.50. See complete line of industrial magnifiers $1 to $25, stocked by leading industrial suppliers. Bausch & Lomb Optical Co., 50425 Bausch St., Rochester 2, New York.

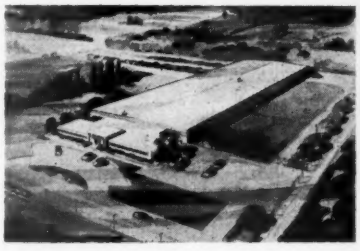
Write today for tell-all handbook and catalog, "INDUSTRIAL MAGNIFIERS, HOW TO CHOOSE AND USE THEM"

B&L BAUSCH & LOMB
Industrial Magnifiers

CIRCLE INFORM-A-GRAM KEY NO. 68

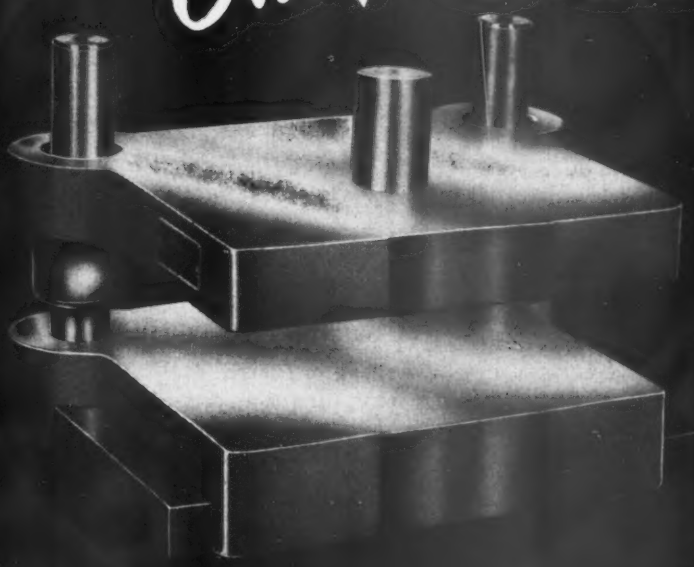
New $1,000,000 Metal Carbide Plant

The Metal Carbides Corporation, Youngstown, Ohio, is constructing a new 40,000-sq. ft. plant on a 25-acre site at 6001 Southern Blvd., Youngstown, Ohio. The new plant will be in operation in January, 1954, and will be used to produce tungsten carbide metal, including tool tips, die nibs, bar stock, rings, bushings and special shapes. Building is of steel, concrete and brick construction and is air-conditioned throughout. Machinery and equipment are laid out to achieve maximum efficiency and economy of process flow. Size and capacity of equipment will enable tungsten carbide metal to be mass produced on a scale not heretofore possible. In addition to tungsten carbide metal, tantalum carbide and titanium carbide will also be produced, as well as tungsten alloy heavy metal, cermets and high temperature alloys, all produced by powder metallurgy methods.



The above new facility will be operated in addition to the main plant at 107 E. Indianaola Avenue, Youngstown, Ohio, which will continue in operation. Total manufacturing space of all plant facilities will be approximately 100,000 sq. ft. All operations from ore and oxides to finished products are performed at Metal Carbides, using the latest laboratory and quality control methods. Powder metallurgy methods, employing both the sintering process and hot-press method, are used to produce dies, rolls and other parts up to diameters of 25", lengths up to 40" and up to 1,000 pounds weight per piece.

Only SUPERIOR DIE SETS



3 For Safer Faster Handling

1 SAFETY FLANGE

protects fingers by providing roomy gripping space on either side of the die shoe. This flange may be mounted flush or on the edge of the die set and is welded in place. *There is no extra charge for this valuable safety feature.*

2 LOCK JAW LIFTING DEVICE

removes the danger of handling large die sets. Heavy steel components of this device are welded in place forming an integral part of the die set. They are positioned to insure proper balance when the set is lifted by either chain fall or crane.

3 E-Z LIFT SLING CHAIN

Is especially designed to fit the safety flanges of the die sets. Male jaws attached to the sling fit quickly into place for immediate lifting. There is no need for screw clamps, eye bolts, or lifting lugs. Nor is there danger of distorting stresses being set up in the die or set because of improper lifting.

It's no longer necessary to take needless risks in handling die sets. Risks that might easily injure the hands of skilled die makers, ruin costly dies in process or completed, or even damage press equipment. Safety features of Superior die sets have eliminated all of these dangers and have speeded up the overall handling of sets from the bench to the press. Prove to yourself the merits of these safety features in both small and large die sets.

FREE CATALOG—*Write today for this helpful data on Superior die sets and die makers' supplies.*

For Fast Local Service Call these Expert Superior Representatives

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- Indianapolis, Ind., BRoadway 5668
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- St. Louis, Mo., Lucas 1223
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30 YEARS OF QUALITY-SERVICE

SUPERIOR STEEL PRODUCTS CORP.
2754 S. 19th ST., MILWAUKEE, WIS.

by Harold H. Sunderlin
SUNDERLIN ORGANIZATION
Cleveland, Ohio

TOOLROOM INCENTIVES . . . *Why Not?*

THE information currently feeding into our office indicates that selling prices can not be raised much if at all, in the face of expected higher labor costs. This puts Management in the position of choosing between lower profits or finding a way to reduce unit costs.

Progressive Management has long used wage incentives for reducing the unit costs of productive operations. These Managers are already thinking of places to which this tried and proven principle can be extended. The tool room immediately comes to their minds as a source of economy for they recognize that it usually is among the least productive of the factory departments.

There is justifiable uncertainty regarding the practicability of applying incentives to tool work when little regard is shown for the principles which have brought about the high productivity found in repetitive manufacturing operations. This refers to the separation of the planning or the thinking from the doing, standardization of productive facilities and materials, division of skill, checks and balances, efficiency reports, costing, scheduling, and and work simplification.

The validity of these principles has been proved beyond question and they are as readily applicable to tool room operation as to production work. Those who do not follow them pay, for good organization unknowingly and at a higher cost and they also deprive themselves of the tight control over production and cost which they would otherwise enjoy.

There should be no uncertainty regarding the practicability of incentives in well organized tool rooms. Moreover, the net cost is lower when they are operated on a production basis irrespective of whether the compensation is day work or the form of individual incentive which has amply demonstrated its effectiveness.

For those who are considering incentives at this time, we have prepared the following check list to assist in the appraisal of their tool rooms in the light of the conditions we have found at the start of more than a dozen tool room incentive programs.

Using the five elements of administration for sub-headings, we shall pose questions and indicate our findings.

Planning

Is There Any Kind Of Load Chart To Indicate The Man-Power Required For The Work To Be Done?

We find, more often than not, that deliveries are not met because man-hours are not correlated with the work load.

Are The Tools Properly Designed?

We usually find that they are too complicated, insufficiently standardized, and that they reflect the whims of the designers rather than the best practice for low cost in the tool room and later in the production department. When die designs have been standardized, as Eastman Kodak has done, these problems are overcome and in addition a die can be designed in minutes rather than hours.

Are The Tool Drawings Properly Detailed?

We often find errors, non-adherence to conventions, and missing dimensions. These faults reduce the toolmakers' productivity because they or someone else have to make corrections and supply the missing information.

Are Tool Orders Scheduled According To Date Wanted?

We find poor control over deliveries as a result of work orders not being scheduled.

Is There A Simple Chart Indicating The Status Of Each Job In Process?

We usually find that the Foreman carries this information in his head or makes a floor check when requested for a report.

Is The Best Method Of Making A Tool Normally Used?

We seldom find that the best method is being used. There is a considerable pick-up in productivity when the thinking is done by the Tool Planners who are properly qualified to do it.

Organizing

Is There Sufficient Supervision?

We find that adequate supervision pays its cost and that using too few Supervisors is false economy.

Are Machine Specialists Used To The Best Advantages?

We find too many journeymen in proportion to the specialists.

Is There Sufficient Inspection?

We find regardless of the method of compensation, that quality is slighted unless rigidly controlled. The cost of adequate inspection is insignificant in comparison with the increased production per man-hour when incentives are used or the loss time in the production department when tools fail to do the job for which they are intended.

Has The Raw Material Been Standardized So That The Designers Know What Kinds And Sizes Are In Stock?

We find a miscellaneous assortment of steels depending upon the individual preferences of those who have had a voice in ordering it. Usually the steel inventory is too large, in total, and yet lacking in certain popular sizes. When the raw material is unnecessarily large, both the excess steel and the time to remove it are wasted.

Is The Inventory Of Raw Material Conveniently Located?

We have found the tool room steels stored with the production steels and located at a point distant from the tool room.

Is The Raw Material Cut Off Beforehand?

We have found that the toolmakers themselves are sometimes required to cut off the steel. A better practice is to use less skilled help to cut it off and to rough it to size before the toolmaker is ready for it.

Is The Machinery And Equipment In Good Condition?

We find tailstocks out of line with headstocks and that measuring tools, both privately and Company owned, have become inaccurate as a result of no regular check having been made.

Are The Specialists Furnished With Everything They Normally Need?

We find that they are supplied with the bare necessities and lose much time going to the crib or

. . . continued on page 74

SPEEDY Zagar-Broaching

CLOSER HOLE TOLERANCES

● Singly or in production lines, three Zagar broaching machines broach small and medium size parts with eye-opening speed and accuracy. Profitable uses: keyways in gears, hubs and pulleys; hexes, squares and irregular holes; sizing holes to close tolerances. Simple, fast, easy to learn; costs little to buy, little to operate. May we study your needs?

ASK FOR OUR NEW DATA SHEET "T-1".

Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY

ZAGAR TOOL, INC.
24000 LAKELAND BLVD.
CLEVELAND 23, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 71

USE
DETROIT
DIE SET
DIE SET NO. OR STYLE SSD-2
DIE SPACE "A" 45" "B" 30"
THICKNESS OF SHOE "C" 3"
THICKNESS OF PUNCH "D" 3"
DIA. OF SHANK NO shank
LENGTH OF PIN 12"
STYLE OF BUSH Steel Shoulder
PREC. OR COMM'L Precision
JOB NO. 5-1044
sure way to get
a quality die set
"USE DETROIT DIE SET," stamped on your blueprint, means you have specified a die set for accurate die work, fast mounting and long life . . . because of Detroit's high standard of factory-built and factory-tested precision.
Detroit
DIE SET
CORPORATION
Call "Detroit"
2895 W. GRAND BLVD.
DETROIT 2, MICHIGAN

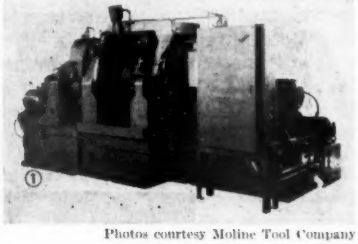
CIRCLE INFORM-A-GRAM KEY NO. 72

Machining Rear Axle Housings

Two special machines have recently been developed for performing machining operations on tractor rear axle housings.

Model MR132, shown in Figure 1, is a special, two-way three unit, horizontal, hydraulic feed machine which drills, spotfaces, counterbores, taper reams and taps the housings.

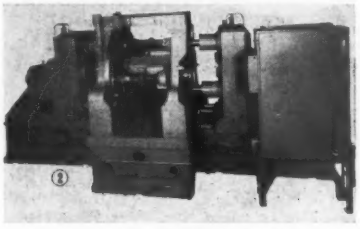
A power indexing, trunnion type fixture with one loading station and four working stations holds the work. Screw operated end clamps, manually operated, hold the axle housings. The machine is designed to accommodate two different types of housing of either right-hand or left-hand design. This is accomplished by providing additional spindles at various positions so that tools may be changed between spindles in order to handle either the left-hand or right-hand part. This machine is arranged to have an automatic, electrically controlled operating cycle. A push button station mounted on the side of the control enclosure serves to control the entire machine. With the work properly clamped in the fixture, the operator presses the button to start the automatic cycle which includes: rotary indexing of the fixture; rapid traverse forward of the tapping head unit, the right-hand drill and ream unit, and the left-hand drill unit. A limit switch starts the tapping motor causing the



Photos courtesy Moline Tool Company

tapping unit to feed forward through the turning of a lead screw; forward travel of the left-hand and right-hand drill and ream units reduces to feed rate; tapping motor reverses direction of rotation, feeds in reverse direction and stops; drill and ream units dwell against adjust-

able positive stops, rapid traverse reverse after timed interval has elapsed and stop, completing the automatic cycle. The operator loads and unloads the work during the operating cycle. Production rate is 80 parts per hour.



The Model MR133, Figure 2, is a special, two-way, two-unit horizontal, hydraulic feed machine which will semi-finish and finish bore right-hand and left-hand rear axle housings for tractors.

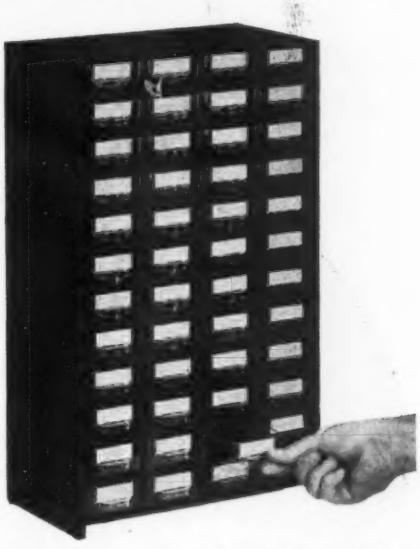
There are two spindles mounted in large anti-friction bearings on each spindle unit. One spindle on each unit is used for the semi-finish operation and the other spindle is for finish boring. Mounted between the boring units is a three-station, hydraulically indexed, electrically controlled, trunnion type fixture with two working stations and one loading station. The operator loads and unloads and clamps the work manually at the front station while boring takes place at the other station. After an axle housing is clamped in place at the loading station, the fixture is power indexed, bringing the part to the second or semi-finish boring station and then to the third or finish boring station. Next, the completed part is returned to the loading station and removed. The fixture is loaded and unloaded at the first station during the operating cycle of the machine.

The hydraulic feed cycle is automatic once it is started by the operator. At the end of the feed stroke, the boring units come up against adjustable positive stops where they remain stationary during a timed dwell, which gives depth control and allows the cutters to clean up the face at the end of the bore before withdrawing at the rapid traverse rate. Production rate is 80 parts per hour.

Plastic DRAWER JIFFY CABINETS

THE BEST WAY TO PUT SMALL ITEMS IN THEIR PLACE!

In every home, in every office, in every shop, there are dozens of small parts requiring easy, convenient storage. The slickest, handiest answer to this problem is the JIFFY Cabinet.



CHECK THESE FEATURES:

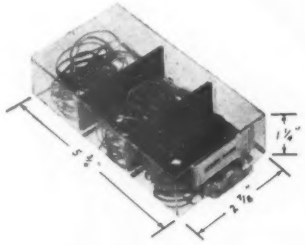
• **3 New Color Combinations**
Cocoa Brown with tan drawers.
Black with gray drawers.
Red with crystal-clear drawers.

• **Solid One-piece Back Panels**
Keep dust out . . . maximum strength girder type construction . . . ready-made keyhole slots for handy wall mounting.

• **Rubber-tipped Cabinet Feet**
Prevent scratching . . . increase stability . . . make stacking convenient.

Illustrated — 48-drawer JIFFY Cabinet, red frame with crystal-clear styrene drawers.....only $19.95*

• **Generously Sized Drawers**
More than 18 cubic inches in each one . . . full set of index labels and drawer dividers supplied with every cabinet.



Inside of drawer easily divided into three compartments with metal dividers as illustrated. Each drawer has a stop to prevent accidental spillage and to permit drawer to hang open from back edge. Ribbed runners on bottom of all drawers permit them to slide freely. Index slots on front of drawers allow easy identification of contents.

HANDY PRODUCTS, P. O. BOX 2447, CLEVELAND 12, OHIO

Please send immediately the quantity, size and color JIFFY units as listed:

☐ 48 Drw. @ $19.95* ☐ 32 Drw. @ $12.95* ☐ 24 Drw. @ $9.95* ☐ 16 Drw. @ $7.95*

☐ Red w/clear drwrs. ☐ Black w/gray drwrs. ☐ Brown w/tan drwrs.
(NOTE: If color is not specified, we will ship Red Cabinet w/clear drwrs.)

WE PAY ALL SHIPPING COSTS

NAME.....
COMPANY.....
STREET.....
CITY.....ZONE.....STATE.....

Open account shipments on company purchase orders. Otherwise, check with order, please. No C.O.D.'s, please. *Ohio customers add 3% sales tax.

CIRCLE INFORM-A-GRAM KEY NO. 73

Double-Circle Testing

ASSURES LONGER LIFE MORE CUTTING MILEAGE!

● Careful testing at Chicago-Latrobe gives accurate appraisal of the number of holes a DOUBLE-CIRCLE Drill will cut before sharpening becomes necessary. Constant effort by Chicago-Latrobe engineers steadily increases performance. High standards of quality and careful inspection of every manufacturing operation is maintained to meet close tolerance specifications...to give you LONGER CUTTING MILEAGE... and less shut-down time.

A variety of types and sizes of DOUBLE-CIRCLE Drills meet every requirement... General Purpose... Heavy Duty... Fast Spiral... Slow Spiral ...Bright Spiral... Carbide Tipped and Specials. Write for booklet No. 179 for description.

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DRILLS • REAMERS • COUNTERSINKS • COUNTERBORES • CARBIDE TOOLS • SPECIAL TOOLS

CIRCLE INFORM-A-GRAM KEY NO. 74

. . . Why Not?, from page 71

improvising when collets, drill sleeves, drill chucks, etc., are in short supply.

Directing

Is The Attitude Of Supervision Progressive?

We have found too many cases of empire building and too few cases of an enlightened attitude which puts the welfare of the Company first. Strangely, we have found that the toolmakers themselves have been more receptive than higher echelons of management to sound organization and incentives.

Are The Foremen, On Their Feet, Helping The Tool Makers?

We do not find the Foremen taking the initiative in helping the tool makers to perform their appointed tasks after the job has been assigned. Since the tool makers are reluctant to ask for help, unnecessary waste of time follows.

Do The Records Of Efficiency, Assuming That They Exist, Indicate Reasons For Failure To Meet Any Kind Of Task Standard?

We usually do not find records of individual tool maker efficiency and, in the cases where such records have been available, the reasons for an individual's failure to perform as expected has not been indicated.

Coordinating

Is There Coordination Between Tool Design Department And Tool Room?

We usually find some loss of time in the tool room because tool drawings are not properly understood. After coordination has been improved, there is a two-way flow of ideas which benefits the Designers as well as the tool makers.

Is The Tool Room Supplied With Specific Information Regarding The Repair Of A Broken Tool?

We find tool orders marked "Repair" instead of designating what specifically is required. An investigation then has to be made to learn exactly what kind of repair is needed.

Controlling

Is The Timekeeping Properly Done?

We have found a charge of $135 against a $12 tool because the time was not charged to the proper account numbers. This is unusual, of course, but we infrequently find timekeeping and time-charging properly done.

Are Tool Records Kept In Hours Or Dollars?

We have found tool orders indicating the cost in dollars only.

This makes it difficult to compare costs because of the increase in labor rates.

Are The Best Tool Makers The Poorest Producers?

We nearly always find after control has been attained that those who could do the most, as a result of their wide experience, are actually doing the least.

Are The Apprentices Diligent?

We have learned new and ingenious ways of wasting time when we have observed apprentices in tool rooms with conventional training programs. The application of standards to the apprentices' work so increased their interest that, in one case, the program was reduced from four years to three.

A tool room that rates well on the above points is a good tool room. When incentives are applied to a good tool room, the advantages listed below accrue to Management, Labor, and the Customers.

Whether a tool room is large or small, good organization is desirable. In our experience a force of 20 tool makers is the minimum.

Summary

1. We have seen few tool rooms of which Management could be proud, prior to the organizing work done as a preliminary to the adoption of incentives.

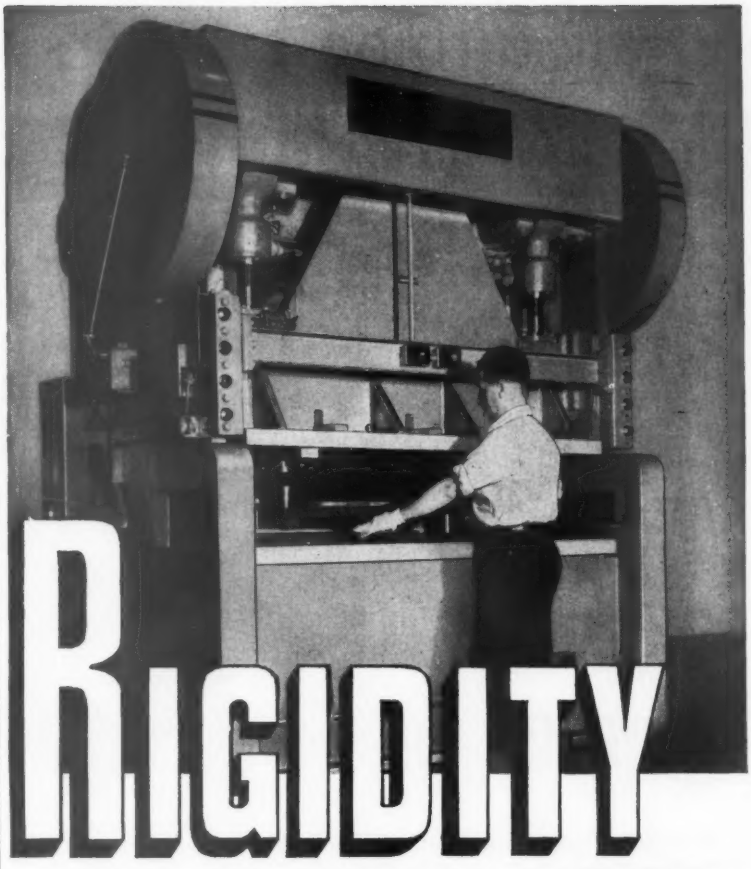
2. Incentives are practical for all but the smallest tool rooms.

3. On an average, 28% of the labor cost has been saved after paying the tool makers including supervision 25% additional wages and paying for the maintenance of the incentive plan.

4. When the toolmakers are given inducement to meet Management goals, the deliveries are improved, the quality of the tools is actually higher, and the tool room force is much more select as a result of receiving materially higher wages. These benefits all add up to greater satisfaction to Management.

5. Regardless of whether incentives are used, tool room must be well organized, if economical operation is to be achieved.

6. The tool room is no different from any other factory operation so far as the application of good management principles is concerned. Those with a progressive attitude and the know-how have proved this point beyond any doubt.



RIGIDITY

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THE RIGIDITY of the Bath Press Type Brake is evidence of its high standard of construction. With speeds of 45 or 60 strokes per minute, it has many outstanding advantages such as Overload Protection, Pneumatic Clutch-Brake, End Feeding, Serial Operation etc.

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For further information and specifications on the Bath Press Type Brakes write for this catalog.

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POWERFUL—
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More power per pound! That's the reason the NEW Buckeye Air Turbine Grinder will cut through grinding jobs faster, with less effort for the tool operator. Versatile—designed for use with tungsten carbide burrs, adaptable to use with rotary files and midget mills, may be mounted on tool post, takes mounted points up to ¼" shank.

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aluminum housing, steel front sleeve for longer wear—LIGHTWEIGHT, DURABLE

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CIRCLE INFORM-A-GRAM KEY NO. 76

Less Pressure Urged in Training for Top Jobs

Industry's efforts to provide extensive and intricate training programs for executives may overburden the prospective top managers of industry and do more harm than good, business leaders attending the fall conference of the Society for the Advancement of Management were cautioned recently.

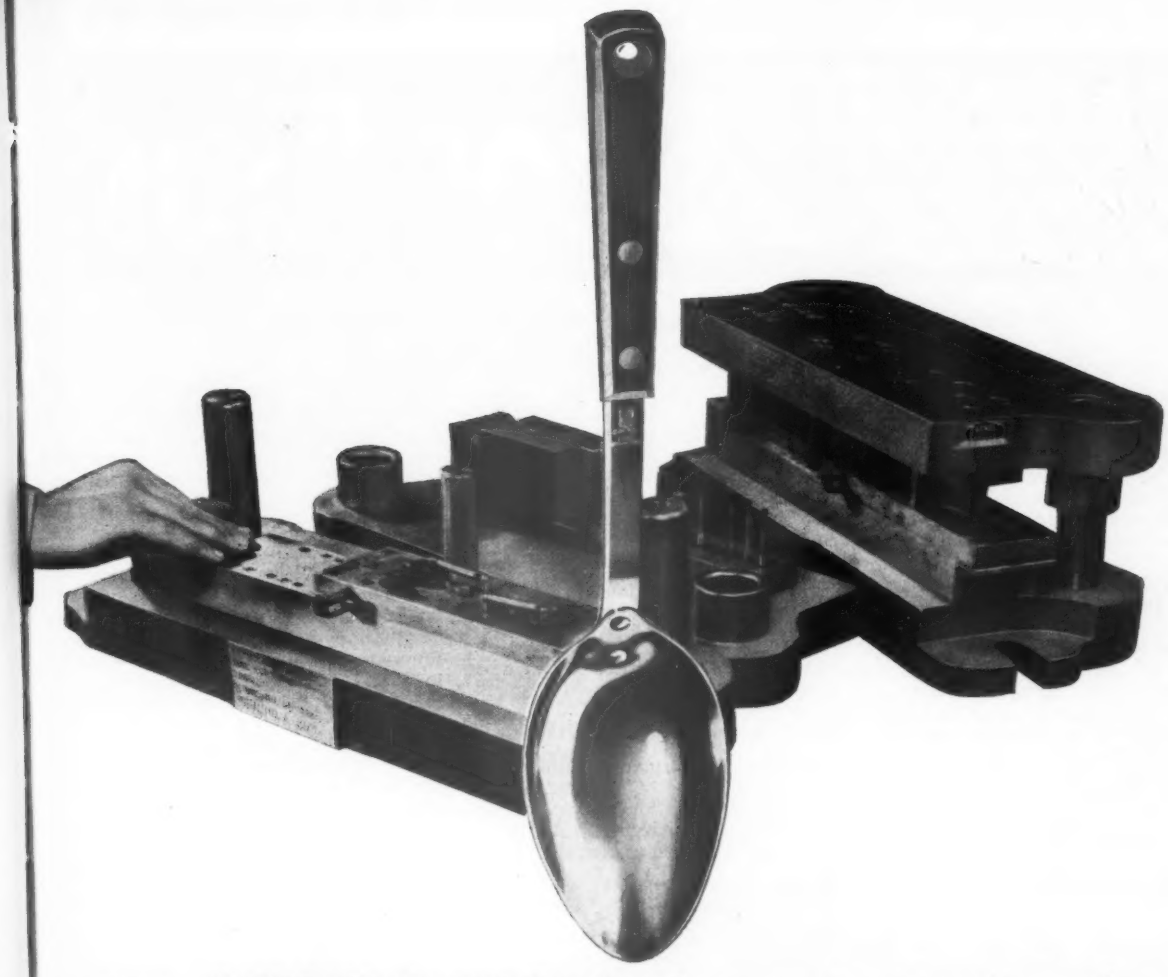
More than 1,000 executives meeting at the Statler Hotel in New York heard James S. Massie, of Minneapolis-Honeywell Regulator Company's Micro division, emphasize that management programs must be tailored to the individual needs of the potential executive. Group programs, he said, should be conducted only where there are indications of compatible group interest.

Of 250 top executives questioned, each of whom had risen within the last three years from the middle management ranks, 95 per cent said they had undertaken some form of self-improvement in the last five years, and all had future plans for such programs. The average executive in this study was a man of 45, with his present company an average of six years. Massie stressed this evidence of an urge on the part of top-management candidates for learning their way to the higher position.

His study also furnished an indication as to which areas the executives felt most needed "polish." For example, some 60 per cent indicated they needed assistance in encouraging staff teamwork; 65 per cent admitted having poor memories; 50 per cent wanted polishing on their conference leadership techniques; 50 per cent also indicated that they wanted more knowledge of business economics, finance and a better understanding of business organization.

Top management, learning of the individual's known or felt needs for self-improvement, is then in a position to counsel him toward the best program for his long-range development

He emphasized that the "polishing programs" in business administration, communication, work and social skills "should begin when the prospective executive first appears on the middle management horizon."



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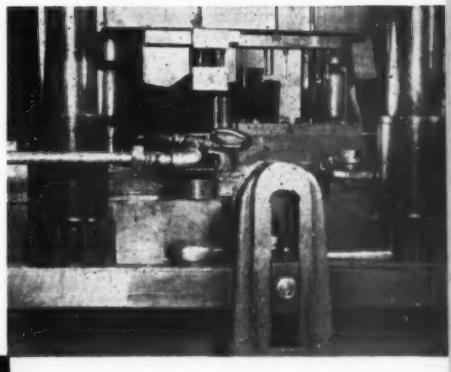
It's a point worth remembering . . . when the job calls for *precision* performance, *depend on Danly Die Sets!* There's a Danly Branch near you . . . stocked for immediate delivery.



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LUBRICATION

Here is a "Shop Notebook" that contains valuable information on machine tool lubrication. A wealth of cutting fluid know-how on the application of oil for cutting, grinding, broaching, tapping and threading and all other phases of metalworking and industrial lubrication is provided. Write to D. A. Stuart Oil Co., 2727 S. Troy St., Chicago 23, Ill.
Circle Inform-A-Gram No. C1.

Stress Values for ferrous pipe and tubing are shown in a new data card designed to help individuals involved in the design and operation of tubular equipment at elevated temperatures and pressures. Copies of this helpful card can be had from the Tubular Products Div., Babcock & Wilcox Co., Beaver Falls, Pa.
Circle Inform-A-Gram No. C2.

Improved Product Design. This folder has been prepared in the interest of better product design. By word, example and illustration it suggests how improved product design can produce savings in space, weight and materials and result in better-looking-performing products —through the use of alloy steel screws. Write to Mac-it Screw Div., Strong, Carlisle & Hammond Co., 1932 W. Third St., Cleveland 13, Ohio.
Circle Inform-A-Gram No. C3.

Abrasive Belt Grinding & Finishing. A new 12-page, illustrated brochure, "The 3M Method of Belt Grinding and Finishing," is now available upon request from the Minnesota Mining and Mfg. Co., 900 Fauquier St., St. Paul 6, Minn. The booklet describes the 3M method of using coated abrasive belts as a high speed means of grinding and finishing flat or contoured surfaces.
Circle Inform-A-Gram No. C4.

Cold Finished Steel. Tables and working data of value to users of fine quality steels are featured in this pocket-sized booklet on cold finished steels available from the Pittsburgh Tool Steel Wire Co., Monaca, Pa. Also included is information on carbon tool steels, alloy steels, high speed steels and stainless steels.
Circle Inform-A-Gram No. C5.

Corrosion Resisting Properties of Austenitic Chromium-Nickel stainless steels are explained in this 32-page bulletin that includes 18 tables showing the results of various tests. The publication covers the mechanism of corrosion resistance in stainless steel; their behavior in various corrosive environments and the preferred practice in construction and use of stainless steels. Write to the International Nickel Co., Inc., 67 Wall St., New York 5, N. Y., for Bulletin A-49.

The booklet will prove a very desirable addition to your library or reference file.
Circle Inform-A-Gram No. C6.

For Your Information here is a booklet that briefly, but concisely, describes the function and operation of optical comparators. Actually this instrument is a precision ma-

chine which inspects and measures with speed and accuracy. The booklet is available upon request from Jones & Lamson Machine Co., Springfield, Vt.
Circle Inform-A-Gram No. C7.

Better Grinding. This comprehensive, 84-page book, with spiral binding, contains 17 chapters devoted to basic grinding facts as they pertain to any make cylindrical grinder. There are more than 90 practical, cartoon-type illustrations dramatizing various grinding operations. Valuable tips are included on the following: how to set up grinding jobs; how to operate precision cylindrical grinders; how to take proper care of cylindrical grinders; and how to turn out better grinding jobs. Already this publication has helped train thousands of new machine operators. It is available from the Landis Tool Co., Waynesboro, Pa.
Circle Inform-A-Gram No. C8.

Stainless Steel. The Carpenter Steel Co., Reading, Pa., offers a colorful chart giving its method of identifying stainless steel. This method is useful in separating various types that show marked differences in their physical properties.
Circle Inform-A-Gram No. C9.

Measuring Tools. This is a catalog and handbook specifically designed for those who require precision measurements. It fully describes precision measuring tools from a A to V, ie, Amplifying gage anvils to the Vogel method of measuring general screws. For your copy write to the Van Keuren Co., 178 Waltham St., Watertown, Mass.
Circle Inform-A-Gram No. C10.

Annealing Alloy Steels. Here is a handy slide calculator which provides data on standard AISI analyses ranging from 1035 to 9850—for both conventional and isothermal anneal. One side gives information for producing lamellar structures, the other for spheroidal structures. Get your copy from the Republic Steel Corp., 3110 E. 45th St., Cleveland 27, Ohio.
Circle Inform-A-Gram No. C11.

Live Centers. What you should know about live centers is the theme of Bulletin 105 offered by Falls Products, Inc., 130 N. Genoa St., Genoa, Ill. Besides a general discussion on the centers, the booklet covers dead center accuracy, dead center rigidity, quick adjustment for rigidity and maintenance ease and operation.
Circle Inform-A-Gram No. C12.

RIVETING WITH HI-SHEARS

This is the fourth edition of a pocket manual written especially for shop riveters and inspectors. Simplified drawings and non-technical language contribute to its ease of reading and its general value. Complete recommendations are included on hole preparation; riveting methods and technique; inspection; identification and trouble shooting. Revisions have been made in riveting gun and squeezer equipment recommendations. Write to The Hi-Shear Rivet Tool Co., 8924 Bellanca Ave., Los Angeles 45, Calif.
Circle Inform-A-Gram No. C13.

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CIRCLE INFORM-A-GRAM KEY NO. 79A

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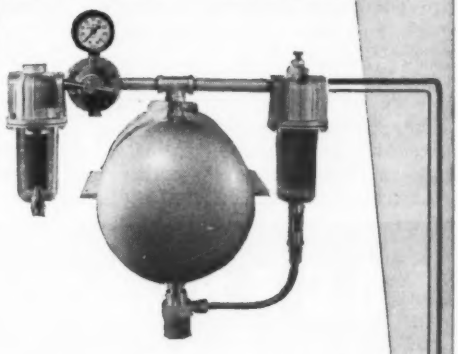

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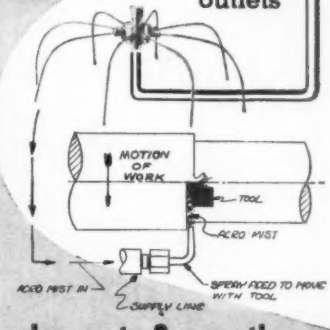

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CIRCLE INFORM-A-GRAM KEY NO. 79B

"THE COMPLEAT ENGINEER"

by T. Keith Glenman
President, Case Institute of Technology
Cleveland, Ohio

Izaak Walton, patron saint of fishermen, wrote in the seventeenth century of "The Compleat Angler," a title which we may appropriately paraphrase as the goal of modern engineering education—to produce the "compleat engineer." And just as it is easy for the angler to become so completely captivated by the pleasures of solitude, so it is all too easy for the modern engineer to become an introvert—"a cold fish" as George J. Huebner, Jr. has pointed out—and to isolate himself from the problems and responsibilities of society.

This danger has caused our faculty at Case to take specific steps toward the broadening of our students' education. For that reason, Mr. Huebner's excellent talk "A Message for Engineering Students" gave me real satisfaction since he emphasized many of the qualifications which we are stressing in our undergraduate curricula at Case Institute of Technology.

All of our students now spend approximately twenty-five per cent of their time in a four-year integrated program of study in our Division of Humanities and Social Studies. The goals of these courses and the responsibilities of this Division may be briefly summed up as follows:

1. To prepare the engineer to express his ideas clearly and concisely in both speaking and writing.

2. To give him an understanding of and convictions about his responsibilities as a citizen in a democracy.

3. To provide him with a knowledge of the background of the social organization within which he lives and of the great expressions of the human mind concerning man and society.

4. To stimulate his interest in some aspect of the humanities or social studies as a basis for continued study or pleasure in these pursuits.

I believe that these goals are sound and that the courses in which we seek to attain them not only offer intangible values but provide practical preparation for the engineer's career in industry. In commenting on the latter aspect, Professor Robert L. Shurter, Director of the Division of Humanities and Social Studies, wrote in the **General Electric Review** (September, 1952):

"I am convinced that study in the humanities and social studies has an intensely practical value for the engineer's career, quite apart from the aspects of personal enjoyment or personality development which I have already mentioned. If it is proper to assume that the engineer is likely to rise to executive posi-

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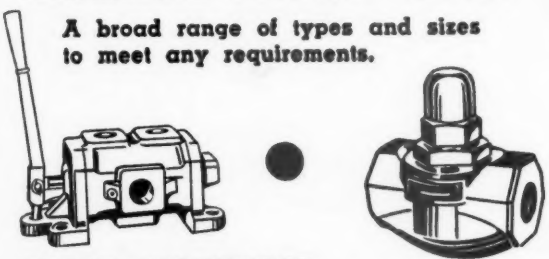

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Editor's Note: In our July 1953 editorial we made disclosure of a most stimulating address, "a message for engineering students", made by Chrysler Corporation's George J. Huebner, Jr., before the University of Michigan chapter of Tau Beta Pi, national honorary engineering fraternity. Mr. Huebner, Chrysler Chief Research Engineer, currently is Executive Engineer in charge of Chrysler Corporation's research and development program on guided missles for Army Ordnance.

Our editorial offer to provide interested readers with copies of Mr. Huebner's talk met with a response far in excess of our anticipations; nearly two thousand copies having been requested to date.

Here in Cleveland, Assistant Editor Carl Benner told Keith Glennan, President of Case Institute of Technology something of the widespread appeal of Mr. Huebner's message for engineering students. Dr. Glennan was extremely interested and after reading the talk was disposed to comment on it in terms of his efforts, as head of one of the country's leading engineering educational institutions, to insure that Case engineering graduates are equipped to serve society in the fullest sense; in that they may be able to "lead men, direct men, persuade men and inspire the confidence of men."

Dr. Glennan has brought to the world of education administration a rich experience in industry and engineering. He is an electrical engineering graduate, cum laude, of Sheffield Scientific School, Yale University. He holds honorary degrees of Doctor of Science from Clarkson College of Technology and Oberlin College, and of Doctor of Engineering from Stevens Institute of Technology and Fenn College.

After graduation from Yale, in 1927, Dr. Glennan was employed by ERPI, a subsidiary of Western Electric, installing sound equipment in theatres in this country and abroad. In 1934, he went to Hollywood, first as Vice President and General Manager of General Service Studios and later as Operations Manager of Paramount Pictures. In 1939, he was named Manager of Paramount and later held the same position at Samuel Goldwyn Studios.

In 1942, he became Administrator and later Director of the United States Navy Underwater Sound Laboratory at New London, Connecticut, operated by Columbia University's Division of War Research. For this service he was awarded the Medal for Merit, highest United States civilian award.

In June, 1945, he accepted a position on the executive staff of the Ansco Division of General Aniline & Film Corporation in Binghamton, New York with major responsibilities for engineering and administrative activities. On September 1, 1947, he assumed his duties as fourth President of Case Institute of Technology.

Dr. Glennan was nominated as a member of the Atomic Energy Commission by President Truman, August 11, 1950. His appointment was confirmed by the Senate, August 22, 1950. He resigned from the Commission November 1, 1952.

We are privileged to present Dr. Glennan's "Compleat Engineer." **E. W. P.**

tions in the future—and most existing surveys show that this assumption is well founded, then these future managers will undoubtedly have to deal chiefly with problems of human relations in the area of labor and management, and with government.

"To cope with these problems adequately, these future managers will have to understand the general principles on which individuals and societies operate. For that reason, the habits of thought, the background information, and the standards of values, which today's engineering student has, are of the utmost importance to tomorrow's industrial society. In this context, it seems to me that study of the humanities and social studies can make very important contributions to the total education of the engineering or science student."

Another important aspect of our program in the Division of Humanities and Social Studies is the setting up of a complete Reading Laboratory to help our students read faster and with

... Continued on page 120

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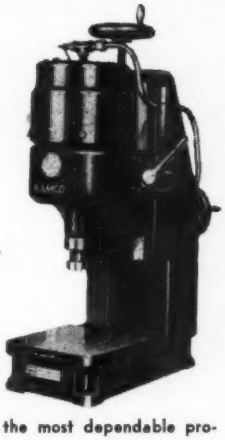

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For Ease and Convenience Use TOOLING and PRODUCTION Inform-A-Gram Cards

Brake Dies. Any practical size or shape brake die can be developed by the experienced engineers at the Service Machine Co., 158 Miller St., Elizabeth 4, N. J. How these dies are made and examples of some that SEMCO makes regularly are the topics for discussion in the firm's "32 Year Brake Dies" brochure. **Circle Inform-A-Gram No. B1.**

Salt Bath Heat Treatment. The primary purpose of this booklet, put out by the Industrial Chemicals Division of the American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y., is to acquaint the reader with modern salt baths. Besides illustrations, tables, charts and diagrams are included in the brochure. **Circle Inform-A-Gram No. B2.**

Here's what the plant manager at Avey Drilling Machine Co., Cincinnati, has to say about Standard's Twin Wheel Tool Grinder:

"Any grinder that stands the punishment that we give it here at Avey must be a good grinder. All day long, day after day, we grind Carbide tipped lathe tools including boring, cut-off forming, and other high-speed steel tools. Maintenance has been only routine. Down time . . . none. Its economy is amazing."

Why not install a Standard Twin Wheel grinder in your plant? Available in 10" and 14" wheel sizes, wet or dry. No spray or splash when wet grinding. Two operators can grind at once. Conserves floor space. Write for Bulletin TW.

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much longer wheel life

one step from rough to finish grind

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CIRCLE INFORM-A-GRAM KEY, NO. 82

Pallet Dollies. Easy steering pallet dollies, light weight pallet dollies and heavy duty- floor-protecting dollies are illustrated and described in a new bulletin just issued. Copies mailed promptly on request to Samuel Olson Mfg. Co., Inc., 2423-27 Bloomingdale Ave., Chicago 47, Ill. **Circle Inform-A-Gram No. B3.**

Centri-Fuse" Bearings. A few of the many standard and special applications for the Waukesha "Centri-Fuse" bearings are listed in this well-illustrated and interesting folder. The bulletin is available from Waukesha Bearings, Div. of Waukesha Tool Co., 1426 Arcadian Ave., Waukesha, Wis. The firm's many types of bearings are used on turbines, compressors, electric motors, etc. **Circle Inform-A-Gram No. B4.**

Permanent Magnets. Latest information on the use, design, properties and manufacture of Alnico permanent magnets, sintered grade 5, is available in the 6-page technical report, PM-111, recently issued by the Carboloy Department of General Electric, Detroit 32, Mich. The report offers charts, graphs and photomicrographs in explanation of magnetic and physical characteristics of the magnets and a table of tolerances to aid the designer. **Circle Inform-A-Gram No. B5.**

500 Jig & Fixture Components. A newly completed two-color folder describing the expanded line of jig and fixture components is now avail-

able from the Jergens Tool Specialty Co., 712 E. 163rd St., Cleveland, Ohio. Among the items covered are blank jaws, sine fixtures keys, malleable handles and Tee slot nuts and bolts. **Circle Inform-A-Gram No. B6.**

PREVIEWS

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TOOLING and PRODUCTION'S Inform-A-Gram Section is a CARDload of Information

Brust Tool Expansion. An illustrated brochure featuring the facilities behind the complete services rendered by the Brust Tool Mfg. Co., River Rd. & King St., Franklin Park, Ill., is available from the design and engineering firm. The company which has just expanded, specializes in custom-built high-production machinery; tools and dies; and a production service on precision parts and products.
Circle Inform-A-Gram No. B7.

Precision Boring Machines. This booklet contains, among other things, many practical examples of tooling on the various models of Ex-Cell-O precision boring machines. Also included, are pictures, drawings and specification that will give you a detail idea on the boring machines made by the Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Circle Inform-A-Gram No. B8.

South Bend Machine Tools. South Bend Lathe Works, South Bend 22, Ind., has collected into one large bulletin the complete story on their many machine tool attachments and accessories. "165 Reasons Why" offers a bird's-eye view of the job range now possible with their new lathes, drill presses and shapers. The handy, pocket-size booklet contains 160 illustrations. Ask for Catalog 5321C.
Circle Inform-A-Gram No. B9.

Mechanical Steel Tubing. Hundreds of products can begin—economically—with a length of tubing It provides the properties needed in the finished product-plus ease of fabrication, and often makes possible a more simplified and improved design. How designers, fabricators and finishers save with B & W tubing is related in a brochure on mechanical steel tubing put out by The Babcock & Wilcox Co., Tubular Products Division, Beaver Falls, Pa.
Circle Inform-A-Gram No. B10.

Hot-Melt Plastic Coating. Fidelity's "Dip-Pak" Hot Melt Plastic Coating offers protection and easy application for such items as bearings; ball and roller sleeve; precision tools, threaded elbows, T's and valves; and many other parts. A folder giving instructions on how to use "Dip-Pak" and the types of plastic coatings is yours for the asking. Write to Fidelity Chemical Products Corp., 470 Frelinghuysen Ave., Newark, N. J.
Circle Inform-A-Gram No. B11.

Heavy Duty Adjustable Perforating Dies. S. B. Whistler & Sons, Inc., 762 Military Rd., Buffalo 23, N. Y., has a new series of heavy duty adjustable dies for group perforation in ¼" thick mild steel. The firm's Catalog 53HD gives full particulars, including illustrations, diagrams, and specifications.
Circle Inform-A-Gram No. B12.

"Blue Chip Investment" is what they call the new Kroslok face milling cutter and shell end mill. With this tool you get faster feeds and speeds. A brochure giving a detailed picture of the cutter and end mill is available from the Motch & Merryweather Machinery Co., Cleveland 13, Ohio.
Circle Inform-A-Gram No. B13.

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It means POSITIVE REGISTRATION at the shear point—at the first stroke and at the millionth . . . and DIES LAST LONGER.
It means LOW FRICTION die set operation, eliminating galling of pins . . . speeding production.
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Yes, you can forget your lubrication troubles with Lempco Anti-Friction Ball Bearing Die Sets with patented MINUS TOLERANCE Ball Bearing Retainers.
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PRODUCE PRECISION QUALITY
Licensed Under Inventions of Guy O. Connor
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BALL BEARING DIE SETS
LEMPCO PRODUCTS, Inc., Industrial Division . . . Bedford, Ohio

CIRCLE INFORM-A-GRAM KEY, NO. 83

Jig & Body Fixtures. Diagrams and specifications in this folder help acquaint you with Standard jig and fixture bodies available from the Smith Engineering and Tool Co., 191 Bay Ave., Glen Ridge, N. J.
Circle Inform-A-Gram No. B14.

Hitch Feed. A factual new bulletin on the Dickerman 2⅛" Model K hitch feed has just been issued by the H. E. Dickerman Mfg. Co., 321-324 Albany St., Springfield, Mass. Ten additional catalogs on die feeds, hitch feeds and other Dickerman products also will be sent to those requesting the new literature.
Circle Inform-A-Gram No. B15.

Vernier Depth Gages. A pocket-sized, four-page circular on two-seat Vernier depth gages is available from Wm. A. Koenig, 108 Mt. View Ave., Troy, N. Y. Illustrations and specifications included.
Circle Inform-A-Gram No. B16.

Adjustable Adapters & Spindle Extension Assemblies are featured in Scully-Jones' Bulletin No. 6-50. Illustrations, specifications and dimensions are also presented on quick-lock nuts and spindle conversion sleeves. For your copy write to Scully-Jones and Co., 1901 S. Rockwell St., Chicago 8, Ill.
Circle Inform-A-Gram No. B17.

with **DEDLOCK**

★ **DEDLOCK is selflocking**
★ **DEDLOCK holds cutters 100% rigid**
★ **DEDLOCK eliminates all adaptors**
★ **DEDLOCK cutters are changed in seconds**
★ **DEDLOCK means increased production**
★ ONLY ONE DEDLOCK CHUCK IS REQUIRED TO HOLD CUTTERS FROM 2" TO 6" IN DIAMETER

OPERATION:	Milling of 2" wide face
CHUCK:	Dedlock #D 50 International
CUTTER:	Dedlock #DC 5, 3" diameter
MATERIAL:	Mild steel
DEPTH OF CUT:	·250"
WIDTH OF CUT:	2"
FEED PER MIN:	7½"
SPEED PER MIN:	110 R. P. M.

Clarkson, Incorporated
320 Ontario Street
Toledo, Ohio
Gentlemen:
Send full information and prices on DEDLOCK Chucks and Cutters to:
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COMPANY.....
STREET.....
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KNOWN and PREFERRED THE WORLD OVER

Clarkson INCORPORATED

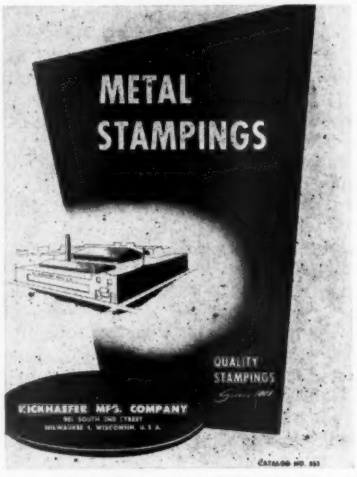
DEDLOCK CHUCKS • AUTOLOCK CHUCKS • MILLING CUTTERS • CLARKSON CUTTER GRINDERS

320 Ontario St., Toledo, O.

CIRCLE INFORM-A-GRAM KEY NO. 84

Production Milling. This rotary head milling machine production idea booklet contains examples of how this milling method has been found exceptionally efficient in solving production, die, forging, and metal pattern milling problems. Address requests to Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wis.
Circle Inform-A-Gram No. B18.

Metal Stampings. This illustrated catalog is a book of engineering drawings and specifications on metal stampings. A wide variety of metal stamping parts such as tubing and wiring clamps, pipe clamps



expansion plugs, core hole plugs, retainers, special lock-washers, horseshoe washers and valve spring washers are also displayed. For your free copy write to Kickhaefer Mfg. Co., 901-903 2nd St., Milwaukee 4, Wis.
Circle Inform-A-Gram No. B19.

Guide Pin Covers. A new survey report containing performance results of dies equipped with Elasticone Guide Pin Covers has been prepared for engineers, die designers and purchasing agents by the Central Safety Equipment Co., 2200 E. Huntington St., Philadelphia 25, Pa. The guide pin covers primary purpose is to eliminate the pinch point between bushings and pins, giving complete protection for guide pins and bushings.
Circle Inform-A-Gram No. B20.

Selecting & Operating Shears. Faster, easier ways of selecting, setting up and operating Di-Arco Shears are described and illustrated in a new 14-page booklet available upon request from O'Neil-Irwin Mfg. Co., 626 Eighth Ave., Lake City, Minn. This booklet points out the many different materials that can be sheared—from plastics, fiber, mica, leather and rubber to heavy gauges of aluminum, chrome molybdenum, leaded brass, stainless steel and other spring tempered materials.
Circle Inform-A-Gram No. B21.

Drawn Shell Trimmer. This publication could be the answer to your drawn shell finishing problems. It reports on a new draw shell trimmer especially designed to trim rectangular or square shells with small corner radii. The illustrated bulletin is yours for the asking by writing to Dayton Rogers Mfg. Co., Minneapolis 7, Minn.
Circle Inform-A-Gram No. B22.

Dual Air Valve. For the ultimate in safety for all mechanical presses using air operated clutches, here is a valve designed to eliminate accidental stroking due to valve failure. Construction and installation features of this 1¼" dual air valve are discussed as well as specifications in Bulletin No. 1902 now available from Danly Machine Specialties, Inc., 2100 So. Laramie Ave., Chicago 50, Ill.
Circle Inform-A-Gram No. B23.

Special Machinery. Actual case histories of jobs "well done" in production, products and profits are related in this catalog now available from Barth Stamping and Machine Works, Inc., 12650 Brookpark Rd., Cleveland 29, Ohio. Described are Barth's universal equipment and skilled personnel on hand for producing tools, dies and special machinery.
Circle Inform-A-Gram No. B24.

Magnetic Chucks. This comprehensive catalog on Superpower magnetic chucks has just been revised and covers the entire line of electromagnetic chucks made by Taft-Peirce. Chuck sizes, specifications and prices are included in it, as well as general information concerning applications and advantages of magnetic chucking. For your copy write to Taft-Peirce Mfg. Co., Woonsocket, R. I. Ask for Catalog No. 411.
Circle Inform-A-Gram No. B25.

New Means of Lubricating. The Extrudite Process, latest Detrex development in lubricants, chemically interlocks a tough, dry, heat-resistant lubricant to the work surface. The procedure for using this process and its many applications are covered in an illustrated booklet available from the Detrex Corp., Box 501, Detroit 32, Mich.
Circle Inform-A-Gram No. B26.

Ejector Pin Counterboring. Here is a "special purpose" tool that performs its job well and gives added tooling performances. The "Built-in" chamfer design automatically allows clearance for the radius under the ejector pin head and insures proper seating of the pin. For further information write to Detroit Mold Engineering Co., 6686 E. McNichols Rd., Detroit 12, Mich., for illustrated bulletin.
Circle Inform-A-Gram No. B27.

Nichols Miller. Detailed description and specifications are given in this illustrated brochure on the Nichols Miller, attachments and accessories. For your copy write to Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Circle Inform-A-Gram No. B28.

Cascade Die Steel. This is a precipitation hardening, prehardened steel that can be used for plastic molds, zinc die casting dies and holding blocks. You can learn all about this die steel by writing to the Latrobe Steel Co., Latrobe, Pa., for the folder on Cascade.
Circle Inform-A-Gram No. B29.

Zinc Die Castings. The end uses of zinc die castings are illustrated and described in this informative booklet available from the New Jersey Zinc. Co., 160 Front St., New York 38, N. Y.
Circle Inform-A-Gram No. B30.

Induction Heating Units. Features of the Lindberg induction heating units, such as the conditioned cooling and industrial tubes are graphically illustrated and explained in Bulletin No. 1440 now available from The Lindberg Engineering Co., 2450 W. Hubbard St., Chicago 12, Ill.
Circle Inform-A-Gram No. B31.

Prove it to yourself right in your own plant...
MID-WEST WHEELS CUT SURFACE GRINDING COSTS!
S11A Mid-West cool cutting wheels have been tested in the tool rooms of our customers all over the country. Results: operating costs were cut, while grinding efficiency was increased!
The reasons are simple. First, because of the quality of materials used. Made with a sharper, harder Aluminum Oxide grain in a glassy vitrified bond, Mid-West wheels offer top grinding results; yet you save on costs. Second, because each Mid-West cool cutting wheel is made for a specific tool room application. Using the right wheel for the right job not only increases grinding efficiency, but speeds up your production time. Your results are bound to be better! See for yourself . . . right in your own plant!
For complete information regarding Mid-West cool cutting grinding wheels, write, wire or phone today.
MID-WEST ABRASIVE CO.
Executive Offices: 510 So. Washington St., Owosso, Mich.
Factories: Owosso, Mich., Rochester, Pa.
MID-WEST QUALITY ABRASIVES
CIRCLE INFORM-A-GRAM KEY NO. 85

Hydraulic Valve. Bulletin 529 gives details and specifications covering the V10 series miniature hydraulic valve recently announced by Skinner Electric Valve Div., Skinner Chuck Co., New Britain. Conn.
Circle Inform-A-Gram No. B32.

Profilometer Amplimeter. A complete description of the new Profilometer Type QA Amplimeter is given in Bulletin LT 87, available from the Micrometrical Mfg. Co., 345 S. Main St., Ann Arbor, Mich. Detailed specifications are included together with photographs.
Circle Inform-A-Gram No. B33.

Magna Drill. A price list and quotation sheet on this universal drilling and tapping machine is yours for the asking from Magna Engineering Co., Menlo Park, Calif. Specifications also included.
Circle Inform-A-Gram No. B34.

Dust Collector. The new, improved Series 12 Aeroturn dust collector, which has a high percentage of air cleaning efficiency, is illustrated and described in the latest bulletin available from Turner & Haws Engineering Co., 87 Gardner St., W. Roxbury 32, Mass.
Circle Inform-A-Gram No. B35.

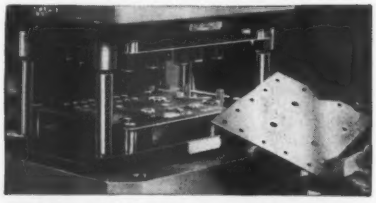
New • Fast • Proven

LOW COST methods for PERFORATING and NOTCHING SHEET METALS

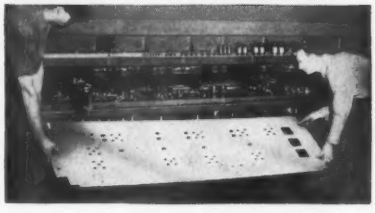
REDUCE DIE COSTS

All units and parts are interchangeable and used repeatedly in different arrangements. **INCREASE PRESS PRODUCTION**—*Down time is minutes as compared to hours for change-over.* For precision work in all types and sizes of presses. **START PRODUCTION AT ONCE.** Pierce materials up to ¼" thick mild steel. Standard sizes and shapes available up to 3 inches. Special sizes to order.

Whistler *MAGNETIC* Dies at work in large inclinable press. Magnetized retainers hold the units. No bolting required. A fast, economical method in making up a punch and die set for short or long runs. All parts re-usable.



Whistler *ADJUSTABLE* Dies on perforating and notching job, using Tee slotted die set. With Whistler Adjustable Punch and Die units production starts within hours instead of weeks. Last minute job changes made quickly.



● Here are the complete details with prices and application illustrations. Send for these catalogs. No obligation.

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S. B. WHISTLER & SONS, Inc.
Adjustable, Magnetic, Custom and Cam Dies for all Industry
748 Military Road, Buffalo 23, N. Y.

For your convenience **Whistler direct factory representatives are located in most principal cities. Their on-the-job application experience, combined with Whistler's 35 years experience in the manufacture of tools and dies, is available on request.**

CIRCLE INFORM-A-GRAM KEY, NO. 86

Advanced Air Gage. The Federal Dimensionair Air Gage is designed to meet the varying measuring requirements of modern design practise. Catalog #53B describes this gage with highly informative data on the calibrated dial, single master system and automatic sorting and machine control applications included. Specifications and information on accessories also presented. Address requests of this data to Federal Products Corp., 1144 Eddy St., Providence, R. I.
Circle Inform-A-Gram No. B36.

Foil Marking Accessory. One of several interesting items in Volume Four, No. One of the Denison Press is a feature story on the foil marking accessory which is another of the accessories Denison has designed for use with the Multipress. Copies of this issue are available by writing to The Denison Engineering Co., 1152 Dublin Rd., Columbus 16, Ohio.
Circle Inform-A-Gram No. B37.

Die Casting Machines. The Lake Erie Engineering Corp., Box 68 Kenmore Station, Buffalo 17, N. Y., has just published a new 8-page catalog on die casting machines. Capacity and pressure tables are an important addition to the new catalog. The maximum specifications of injected metal is shown for each machine model equipped with standard injection units.
Circle Inform-A-Gram No. B38.

Gages. A new 3-color, 4-page catalog on plain and thread reversible plug gages, AGD thread ring gages and setting plugs has been released by the Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill. Condensed for rapid reference, this catalog also includes data on lapping by the centerless method.
Circle Inform-A-Gram No. B39.

"The Case of the Ailing Weldollar" is the title of a new booklet available from the Lincoln Electric Co., Cleveland 17, Ohio. It presents an analysis of the basic causes of high costs of welding and suggests the medicine and treatment needed such as high usable welding currents; faster welding speeds and less machine downtime.
Circle Inform-A-Gram No. B40.

Blue Helix Reamers. These tools are made from high speed steel, expertly heat treated and then subjected to a special hardening treatment. As a result, they cut and hold their accuracy longer and resist chip abrasion. A bulletin giving specifications and dimensions on both the straight and taper shank Blue Helix reamers is available from Pratt & Whitney, Division of Nile, Bement, Pond Co., West Hartford 1, Conn.
Circle Inform-A-Gram No. B41.

Keyway Broach Catalog. The du Mont Corp., Greenfield, Mass., offers a new catalog designed for quick reference on the complete range of

"Minute Man" keyway broaches and sets, including the new Combination Sets, Push-Type Production Broaches, Arbor Presses and Magnetic Bases.
Circle Inform-A-Gram No. B42.

Lathemaster 4-faced tool block and instant change tool holders are described in a new 6-page, illustrated folder. How and why Lathemaster cuts tool setup time to a minimum, speeds work and increases lathe production, is explained in the folder which is available from Marvic, Inc., 350 Peninsular Ave., San Mateo, Calif. **Inform-A-Gram No. B43.**

"Hot Rod" Crystolon Heating Elements are fully described in a new booklet now available from the Norton Co., Worcester 6, Mass. This instructional manual covers such subjects as expected service life, operating temperatures (up to 2800°F), mounting methods, power consumption and electrical data, specifications, operating suggestions and accessories. Ask for booklet No. 146.
Circle Inform-A-Gram No. B44.

The Use of Wire in Product Design is the theme of this handy file-size folder which has photographic evidence of the lightness, strength and functional beauty of low-cost wire assemblies. Demonstrated are such wire form advantages as design simplification and elimination of hand assembly operations. This booklet is obtainable from the E. H. Titchener & Co., 65-69 Clinton St., Binghamton, N. Y.
Circle Inform-A-Gram No. B45.

Wire Brushes. For quickly doing the annoying, time consuming little jobs such as cleaning chips, dirt, scale, removing burrs, metal fuzz from metallic and non-metallic parts, the Osborn Situft wire brush is designed for use in power-driven tools. It is adaptable to drill presses, lathes, bench grinders and portable tools. Write to The Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio, for illustrated bulletin.
Circle Inform-A-Gram No. B46.

Gear Rack Folder. This new bulletin shows many types of gear and rack applications. Copies may be had by writing to Worcester Gear Works Inc., Dept. 7-29, 18 Grafton St., Worcester 8, Mass.
Circle Inform-A-Gram No. B47.

Fluid Power Equipment. This new 12-page Bulletin 10051-C illustrates and describes a complete line of fluid power pumps, motors, transmissions, cylinders and valves. The booklet can be obtained from the Oilgear Co., 1584A West Pierce St., Milwaukee 4, Wis.
Circle Inform-A-Gram No. B48.

Arbor & Hydraulic Presses. This illustrated, pocket-sized bulletin tells of some advantages of the machines made by the Greenerd Arbor Press Co., Nashua, N. H. Specification chart included.
Circle Inform-A-Gram No. B49.

End Wheel Presses of all types are described and illustrated in a new 2-color catalog just issued by E. W. Bliss Co., Canton, Ohio. Specifications for standard, medium and deep throat presses of fixed bed and adjustable bed designs are included. Ask for Catalog No. 4-A.
Circle Inform-A-Gram No. B50.

The Problem: PRECISION BORING TOOLS FOR A LARGE FARM IMPLEMENT MANUFACTURER

The Answer: Lehmann BORING TOOL

Receiving an order for a single end machine with which to semi-finish bore, finish bore, face and chamfer the steel for a final drive housing assembly of a large farm implement manufacturer, the W. F. and John Barnes Co., of Rockford, Ill., came to LEHMANN Boring Tool for the necessary boring tools and carbide cutters.

This is just another example of how LEHMANN stands ready to put more efficiency, accuracy and economy in your boring operations! For more than 35 years LEHMANN has been using their top experience to provide boring tools especially designed and engineered for industry.

5 Reasons Why You Cut Boring Costs with LEHMANN TOOLS

- Tools are precision-built to give . . . ACCURACY
- Uniform design and structure of blocks and cutters gives . . . INTERCHANGEABILITY
- Tool construction rigid, rugged, yet simple, allows . . . INCREASED Speeds and Feeds
- Wide range of bores with a single tool, adjustable cutters, means . . . ECONOMY
- Wide range of ability! Our work with many industries assures . . . successful APPLICATION to YOUR needs

Tell us your boring problems without obligation. Write today for CATALOG BT-12.

Circled below are the tools made for W. F. and John Barnes Co.

Photo courtesy of W. F. and John Barnes Co.

LEHMANN BORING TOOL

4389 Duncan Ave., St. Louis 10, Mo.
DIVISION OF NOVO ENGINE CO.

CIRCLE INFORM-A-GRAM KEY, NO. 87

The General Purpose Precision Lathe with electronic motor control is discussed in detail in Bulletin 1035 now available from the Hendy Machine Co., Inc., Torrington, Conn. Other features also are covered.
Circle Inform-A-Gram No. B51.

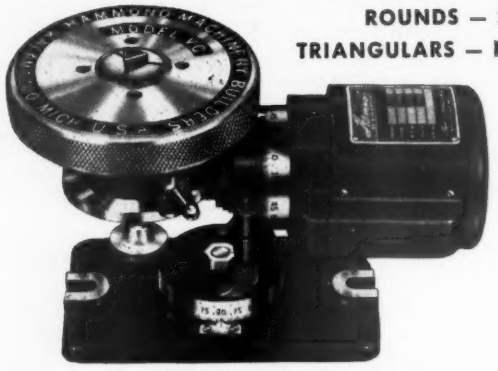
Tube Fittings. This catalog (No. 553) describes the complete line of tube fittings, pipe fittings and accessories carried by the Flodar Corp., 1366 E. 45th St., Cleveland 3, Ohio. It includes important engineering data, installation instructions and tubing recommendations.
Circle Inform-A-Gram No. B52.

Electron Microscope. A new 4-page folder, "Some Reasons Why the World's Most Powerful Electron Microscope Deserves Your Consideration," is available from the Research & Control Div., North American Philips Co., Inc., 750 S. Fulton Ave., Mt. Vernon, N. Y. Forty-four typical applications are listed together with design and operating information concerning the viewing screen, accelerating potential, magnification, electron diffraction, focus determination and control, image stability, resolution and other features.
Circle Inform-A-Gram No. B53.

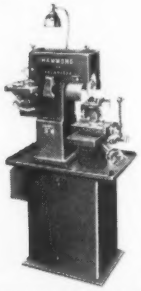
Hammond OF KALAMAZOO
GOOD MACHINERY SINCE '82

INSERT
GRINDING FIXTURE
For Solid Carbide Tools

ROUNDS — SQUARES
TRIANGULARS — RECTANGULARS



MODEL VC, Style M Motorized Solid Carbide Insert Grinding Fixture. Style H, without motor also available. Write for Bulletin No. 235.



HAMMOND MODEL CB-77 CHIP BREAKER AND DIAMOND FINISHING GRINDER can be supplied with both the standard Any Angle Vise and the Model VC Solid Carbide Insert Grinding Fixture.

THE Hammond Solid Carbide Insert Grinding Fixture pays for itself in a few weeks. Offers a fast, economical and accurate means of grinding chip breaker grooves in round, square, triangular and rectangular shapes and for rough and finish grinding of dull and damaged carbide inserts. Motorized Style M with lug base can be mounted on most tool and surface grinders and Hammond C-76, CB-77 and CB-77W Chip Breaker Grinders.

BUILDERS OF AMERICA'S MOST COMPLETE LINE OF CARBIDE TOOL GRINDERS

Hammond Machinery Builders INC

1631 DOUGLAS AVENUE • KALAMAZOO 54, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 88

Precision Forgings. File facts on precision forgings are presented in this informative booklet available from the Utica Drop Forge & Tool Corp., Utica, N. Y. Illustrations aid in covering such forging items as quality control, metallurgy, tooling and production.
Circle Inform-A-Gram No. B54.

For The Aircraft Industry. A 12-page, illustrated booklet to assist aircraft manufacturers in solving tough design and production problems by the proper use of adhesives, coatings and sealers is available from the Adhesives and Coating Div., Minnesota Mining and Mfg. Co., 423 Piquette Ave., Detroit 2, Mich.
Circle Inform-A-Gram No. B55.

Automatic Turret Lathe. Four automatic changes of spindle speed while under cut, three selective automatic changes of feed and automatic binding of the turret following index are some of the new features of the P & J 5-D Power-Flex automatic turret lathes that are described in Bulletin 131. Write to Potter & Johnston Co., Pawtucket, R. I.
Circle Inform-A-Gram No. B56.

How Pennsalt FOS Process can make cold working operations more profitable is described in this folder put out by the Pennsylvania Salt Mfg. Co., 1000 Widener Bldg., Philadelphia 7, Pa. This process is a new method of locking a phosphate coating and lubricant firmly enough onto a steel surface that the steel can be successfully cold extruded on a production-line basis.
Circle Inform-A-Gram No. B57.

Vertical Muffle Furnaces. The surface combustion Atmotrol vertical muffle-type controlled atmosphere furnace is designed for the heat treatment of practically all types of steels, in a muffle. You can get the inside story on this by writing to Surface Combustion Corp., Toledo 1, Ohio, For Bulletin SC-165. It gives you examples of parts that are heat treated in Atmotrol pit furnaces, plus illustrations and specifications.
Circle Inform-A-Gram No. B58.

Electronic Temperature Controller. The range of this unit now is extended to cover—100 to +600F. Bulletin P-811 contains complete specifications, prices and application information on the controller in the single-point and new cascade model, as well as data on resistance thermometer elements and wells, plus Modutrol motors and Industrial Control motors suitable for use with the new unit. Write to Minneapolis-Honeywell Regulator Co., Industrial Div., Station 64, Wayne & Windrim Aves., Philadelphia 44, Pa.
Circle Inform-A-Gram No. B59.

Single Spindle Automatics. Just off the presses is this new bulletin describing Cleveland single spindle automatics. Covered are the 4¼" Models "AB" and "AW." The folder contains illustrations and specifications. Write to the Cleveland Automatic Machine Co., Cincinnati 12, Ohio.
Circle Inform-A-Gram No. B60.

"Metal at Work." Here is a comprehensive study of the products and production methods of the 7 divisions of Continental Copper & Steel Industries, Inc., 345 Madison Ave.,

New York 17, N. Y. Documented by step-by-step operational photographs, the book takes the reader on a detailed trip through the manufacturing processes of each unit. For your copy, write to the company direct or—
Circle Inform-A-Gram No. B61.

Precision Lathe. The dual-purpose Monarch lathe is featured in a new booklet now available from the Monarch Machine Tool Co., Sidney, Ohio. The well-illustrated brochure gives you an operator's eye view of six specific new design advances incorporated in the machine. Individual photographs of the various units of the machine help display the lathe to its best advantage.
Circle Inform-A-Gram No. B62.

Plane Grating Spectrograph. This brochure is for those who have an interest in analytical instrumentation and related problems. The JAco Ebert 3.4 meter plane grating spectrograph described in this literature is one of the first instruments of its kind to become commercially available with a plane grating. The brochure contains illustrations and can be had by writing to the Jarrell-Ash Co., 26 Farwell St., Newtonville, Mass.
Circle Inform-A-Gram No. B63.

3-Dimensional Contouring. Facilities for the production of contoured airframe sections, dies and molds for fiberglass, and metal products are illustrated in an 8-page brochure published by MPM, Inc., 9110 George Ave., Cleveland 5, Ohio.
Circle Inform-A-Gram No. B64.

For Product Design. R. D. Werner Co., Inc., 295 Fifth Ave., New York 16, N. Y., has released a new folder outlining the equipment and services for custom aluminum extrusion and roll forming of aluminum and stainless steel.
Circle Inform-A-Gram No. B65.

Small Rolling Mills. An 8-page bulletin, illustrating its line of precision-built laboratory and production rolling mills, has been issued by the Stanat Mfg. Co., Long Island City, N. Y. Tables show the specifications of the various mills and combination units.
Circle Inform-A-Gram No. B66.

Caster Repair Plugs in sizes 1/16" to ½" in either tapered pipe threads or 27 threads ¾ taper per foot are now available from the U. S. Plug & Fitting Co., Wellington, Ohio. The firm offers an interesting brochure explaining these and other casting repair plugs.
Circle Inform-A-Gram No. B67.

NEW
ROTOR PENCIL
AIR GRINDER
FOR DIES ... PATTERNS
1001 GRINDING JOBS
SPECIFICATIONS
WEIGHT . . . . . 13 ounces
LENGTH . . . . . 5 3/4"
DIAMETER . . . . . 1"
FREE SPEED . . . . . 40,000 R.P.M.
COLLET . . . . . 1/8" or 1/4"
Equipment (Standard)
8 ft. hose and air strainer. Push throttle. Collet wrench. 1/4" collet.
Equipment (Optional)
1/8" collet chuck
Steel rear head. 1/8" air inlet.
Steel rear head. (right angle). 1/4" inlet.
Tool post holder (extra cost).
40,000 R.P.M.
POWERFUL!
Only 13 ounces
Handy
Rugged—Steel
THIS TOOL WILL PAY OFF FAST IN 1001 JOBS. ASK FOR BULLETIN NO. 42. AIR O'TOOL
AIR
HIGH CYCLE
THE ROTOR TOOL CO.
CLEVELAND, OHIO
UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS
CIRCLE INFORM-A-GRAM KEY NO. 89

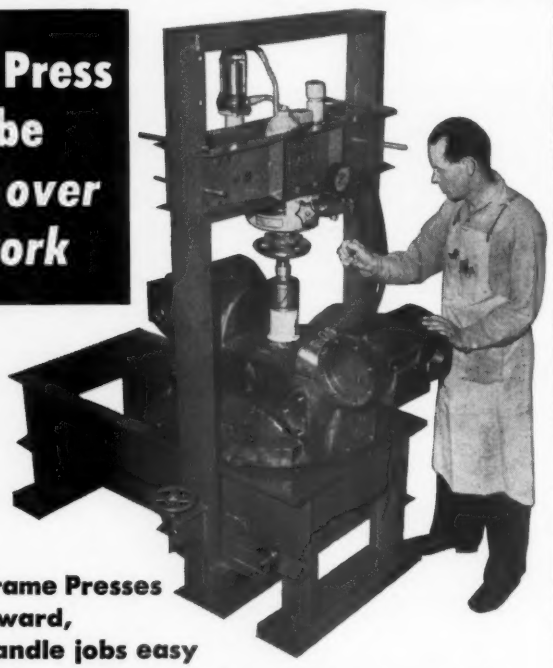
Boring & Facing Machines. Two basic types of bar horizontal boring and facing machines are described and illustrated in a new 4-page bulletin issued by the Simmons Machine Tool Corp., Albany 1, N. Y.
Circle Inform-A-Gram No. B68.

Analog-To-Digital Conversion. This interesting booklet tells how the Consolidated Engineering Corp., 300 N. Sierra Madre Villa, Pasadena 15, Calif., has developed its Analog-to-Digital convertor for recording simultaneous testing functions in continuous chart form.
Circle Inform-A-Gram No. B69.

Metal Cutting Machines. Hydraulic metal cutting machines are illustrated and described in a bulletin now available from Racine Hydraulics & Machinery, Inc., Racine, Wis. Construction details and specifications, plus data on accessories are provided.
Circle Inform-A-Gram No. B70.

"A Report to the Public" is the title of this publication put out by the Eutectic Welding Alloys Corp., 172nd St. and Northern Blvd., Flushing 58, N. Y. The booklet gives you an idea of the type of work done by the welding firm.
Circle Inform-A-Gram No. B71.

THIS Press can be moved over the work



DAKE
Movable Frame Presses make awkward, hard-to-handle jobs easy

Here is the hydraulic press you need for work on awkward, heavy parts, and for handling large straightening jobs. Parts can be loaded on the work table with a hoist or fork truck—then the frame and workhead are centered over the job. The channels and workhead are easily raised or lowered if necessary to accommodate for work height.

DAKE Hydraulic Presses with movable frames are designed for hand, pneumatic, or electric operation. Capacities range from 25 to 300 tons. For detailed information, write for Bulletin 269.

In addition to conventional hand, air and electric hydraulic presses, Dake makes gap type, guided platen, and other special purpose presses.

Dake Engine Company, 634 Seventh St., Grand Haven, Mich.

Send for Big New Catalog

DAKE ENGINE COMPANY
634 Seventh St., Grand Haven, Mich.
Please send me a copy of Dake Catalog No. 129

Name _____
Company _____
Address _____
City _____ Zone _____ State _____

CIRCLE INFORM-A-GRAM KEY, NO. 90

Steel Shop Equipment. Catalog 653 puts on display such steel shop equipment as laminated wood top benches, smooth top steel benches, pressed steel bench legs, steel bench drawers, work stands, tote boxes and welding benches. Illustrations and specifications included. For your copy write to the Industrial Bench and Equipment Mfg. Co., New Britain, Conn.
Circle Inform-A-Gram No. B72.

For the Metal-Working Industry. This booklet has been prepared to serve as an outline of the Turco compounds most generally used in the metal-working industry. It covers such products as acid cleaning and passivating materials; phosphating materials; rust preventives; coolants; and cutting oils. Also included is a variety of charts applicable to the metal-working field. For your copy write to Turco Products, Inc., 6135 S. Central Ave., Los Angeles 1, Calif.
Circlie Inform-A-Gram No. B73.

Tool Room Accessory. A brochure is now available describing some of the many uses of the Precision-made "Bemisine." This new tool room accessory not only determines the angle, but also holds the work. It can convert setup time to working time on grinding, jig boring, drilling and light milling operations. It provides a simple means of dressing precise angles on grinding wheels. Write to the Mutual Machine Co., Hudson, Mass.
Circle Inform-A-Gram No. B74.

Reproduction Materials. Up-to-date information on Kodagraph reproduction materials is provided in a new edition of Eastman Kodak's publication, "Modern Drawing and Document Reproduction." New sections on Kodagraph projection positive paper and Kodagraph microprint paper have been added to the booklet. Also included, is the latest data on sheet sizes, roll sizes and packings. The booklet is available from the Industrial Sales Div., Eastman Kodak Co., Rochester 4, N. Y.
Circle Inform-A-Gram No. B75.

Broaching. This is a reprint of an article, "Broaching Automotive Castings at 200 Feet per Minute", publication M-1821, by John Wetzel, General Master Mechanic, Dodge Division, Chrysler Corporation. It explains how many parts for the new Dodge "Red Ram" V-8 engine are being produced faster and at lower cost by means of huge horizontal broaching machines using planer type, inserted tungsten-carbide-tipped broaching tools and operating at speeds up to 200 ft. per minute. The reprint is available from Cincinnati Milling Machine Co., Cincinnati 9, Ohio.
Circle Inform-A-Gram No. B76.

Gear Burring & Chamfering. Information on the Universal Burr-Masters built by Modern Industrial Engineering Co., 14230 Birwood Ave., Detroit 4, Mich., for production gear burring and chamfering is included in the firm's Bulletin 103-60. This new Universal machine is capable of chamfering the entire tooth form of both spur and helical gears.
Circle Inform-A-Gram No. B77.

Pipe Bending. Various types of machinery that can bend pipe, hot or cold; by hand or power are illustrated and described in a folder now available from "American" Pipe Bending Machine Co., Inc., 15 Furnace St., Poultney, Vt. This company offers a complete line of pipe benders for any radius up to 180° at standard radius or special radii to specifications.
Circle Inform-A-Gram No. B78.

Ultrasonic Testing. The Sperry Ultrasonic Reflectoscope is one of the latest developments in the field of non-destructive testing instruments. It is used to test a variety of metals and materials for surface and internal defects. Complete details, including specifications, on the reflectoscope are contained in an illustrated brochure now available from Sperry Products, Inc., Danbury, Conn.
Circle Inform-A-Gram No. B79.

Stainless Steel Arc Welding Electrodes. This bulletin not only furnishes the reader with complete information on each electrode in Metal and Thermit's line of stainless steel electrodes, but also serves as a handbook on stainless steel. It contains practical working information on the metallurgy of stainless steel. For your copy write to Metal and Thermit Corp., 100 E. 42nd St., New York 17, N. Y.
Circle Inform-A-Gram No. B80.

Metal Washing Compound. A new two-color catalog sheet describing Ipsen Metal Washing Compound 103 is being released by Ipsen Industries, Inc., 715 S. Main St., Rockford, Ill. The fully illustrated brochure gives data on the new non-corrosive, ferrous metal cleaning concentrate designed for quick removal of quenching oils after heat treating.
Circle Inform-A-Gram No. B81.

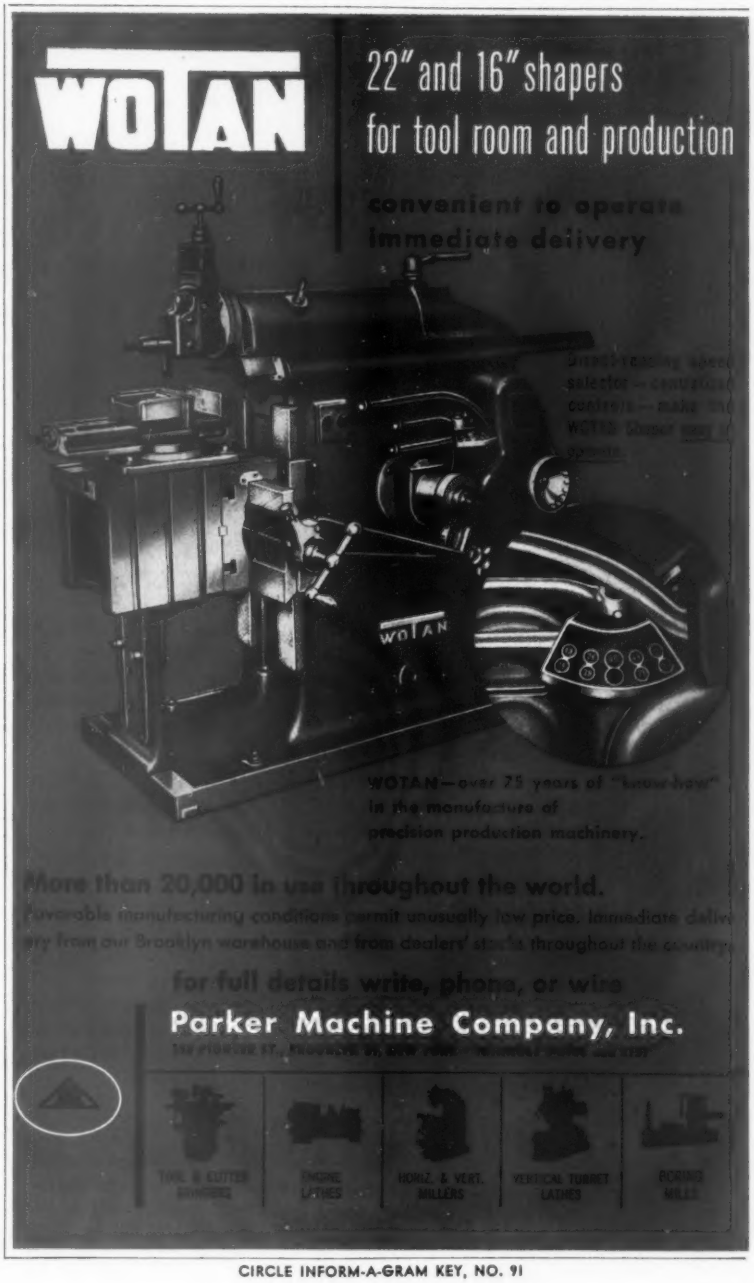
Micrometers. The DoAll Co., national distributors for the Tumico line of precision measuring instruments, announces the availability of a new catalog covering this line. The 36-page booklet gives full illustrated details on Tubular micrometers, plus dial indicators, height gages and depth gages. The catalog can be obtained by writing to DoAll Co., Des Plaines, Ill.
Circle Inform-A-Gram No. B82.

Solid Carbide and Carbide Tipped Tools. The Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich., has released its new net price schedule on solid carbide and carbide tipped tools.
Circle Inform-A-Gram No. B83.

The Universal Radial Cutter Grinder Fixture does 5 operations without removing the cutter from its arbor. Read all about this machine and other attachments and accessories for cutter sharpening in Booklet No. 602 being offered by the Rocheleau Tool & Die Co., Leominster 2, Mass.
Circle Inform-A-Gram No. 884.

Optical Projection Comparators made by the American Optical Co. are on display in this illustrated brochure available from Optical Gaging Products, Inc., 26 Forbes St., Rochester 11, N. Y.
Circle Inform-A-Gram No. B85.

Securing Workpieces. This folder relates the time-saving method of securing workpieces to machine tools as offered by the J & S Tool Co., Inc., 644 West Mount Pleasant Ave., N. J. Highway No. 10, Livingston, N. J. It tells how J & S jaw clamps help secure faster setups.
Circle Inform-A-Gram No. B86.


WOTAN
22" and 16" shapers
for tool room and production
convenient to operate
immediate delivery
WOTAN—over 75 years of "know-how"
in the manufacture of
precision production machinery.
More than 20,000 in use throughout the world.
for full details write, phone, or wire
Parker Machine Company, Inc.
CIRCLE INFORM-A-GRAM KEY, NO. 91

MEN YOU SHOULD KNOW . . . . . .

C. E. Schmitt

Gregg Manchester

H. Sturgis Potter

Arlington A. Britton, Jr.

John Moxon

Charles E. Schmitt, former machine and tool buyer for the Cleveland Cadillac Tank plant, has been named sales engineer for the Ace-Central States Machine Tool Company of Detroit. Schmitt has his office in the Carnegie Hall Building in Cleveland. He is a mechanical engineer and has been associated with the tool and die industry in Detroit and Cleveland for many years.

◆

Gregg Manchester has been appointed to head the newly created public relations and advertising department of the Wesson Metal Corp., Lexington, Ky., Wesson Co., Detroit, Michigan. and Manchester was formerly public relations director and advertising account executive with the Rolfe C. Spinning Industrial Advertising Agency in Detroit.

◆

Three executives of the Carpenter Steel Co., have been elected vice presidents of the firm by the Board of Directors. They are H. Sturgis Potter, Arlington A. Britton, Jr., and John Moxon. Potter will be in charge of sales of the main Reading, Pa., plant. Britton will be in charge of production and Moxon is now vice president, treasurer and secretary.

◆

Barber-Colman Co. announces the appointment of Robert A. Horner as divisional manager of the Machine and Tool Divisions. Leo W. Reuland has been appointed to sales manager of the Machine and Small Tools Division, succeeding Horner. Fred B. Jensen replaces Reuland as production manager of the Small Tool Division.

When you "SAVE"...
YOU LOSE!
"Saving" by making your own punches is old-fashioned and expensive.
Here's why:
1. PORTER PUNCHES are available for immediate delivery.
..... they save time — money — by keeping your expensive help at profitable jobs.
2. PORTER PUNCHES are made to "stand the gaff."
..... punches made in your shop are probably made from "available" material ... often the wrong metal for the job.
3. PORTER PUNCHES are offered in standard—and decimal sizes.
..... so your experienced help doesn't spend costly time "whittling."
4. PORTER PUNCHES are reasonably priced.
..... only a "specialist" can make punches as well—or as inexpensively.
Check your labor costs — your "down-time"— and order
PORTER PUNCHES
— for immediate delivery. Save time — save money — with top quality punches and die buttons. Look to Porter for
the punch you need... when you need it!
Remember — you don't save by making your own punches — you lose.
"Still the best performer"
PORTER PRECISION PRODUCTS
PRinceton 6338
P.O. Box 208
Cincinnati 15, Ohio
Porter Punches are in stock in all principal cities.

CIRCLE INFORM-A-GRAM KEY NO. 92

. . . . . MEN YOU SHOULD KNOW

J. L. Woll

Frank Long

M. N. "Mel" Cain

N. R. Kidder

A. William Tilder

J. L. Woll has joined the sales engineering staff of the Honan-Crane Company of Lebanon, Ind. He will work out of Pittsburgh, covering western Pennsylvania and the Wheeling, W. Va. area.

◆

E. W. Bliss Co., Canton, Ohio announces that Frank Long has joined the firm's Cleveland, Ohio office as sales engineer. Prior to joining Bliss, Long was in military service and served as commanding officer of the Cleveland Ordnance District's regional Ohio offices in Akron, Cleveland and Toledo.

◆

M. N. "Mel" Cain has been appointed district manager of the Minnesota, North Dakota and South Dakota territory for Lempco Products, Inc. Cain joins the Bedford, Ohio firm after serving many years in the automotive industry as a salesman and sales manager.

◆

Jones & Lamson Machine Company of Springfield, Vt., announces the establishment of a market & sales analysis division with N. R. Kidder as division manager. Kidder comes to Jones and Lamson from the Department of the Army Operations Research office, where he served as civilian research consultant.

◆

A. William Tilder has been appointed sales manager of the Guide Pin and Bushing Division of Lamina Dies & Tools, Inc. In his new position, Tilder will head up the sales of the patented Lamina guide bushings and guide pins.

DICKERMAN LEADS AGAIN . . .

with the NEWEST DEVELOPMENT in . . .

Hitch Feeds!

New 2½" Model K Hitch Feed

FIRST

NO OTHER FEED — AT ANY PRICE — OFFERS ALL THESE PRODUCTION INCREASING ADVANTAGES!

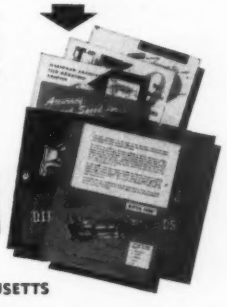
NEW MEEHANITE CASTINGS
Massive frame of virtually indestructible meehanite makes the new Model K the strongest hitch feed ever built.

LONGER FEED LENGTH
Extra frame strength allows full 2½" feed length on stock up to 5" in width.

CARBIDE GRIPPER PLATES
Carbide gripper and wear plates are standard on this new, rugged, versatile feed.

A great, new addition to the Dependable Dickerman line — a feed that will outlast almost any die — trouble free, accurate — day in — day out operation speeds production and actually cuts parts cost up to 60%.

Send for LITERATURE and CATALOGS on the complete line of Dickerman MONEY-MAKING FEEDS.



Dickerman

H. E. DICKERMAN MFG. CO.

324-218 ALBANY STREET SPRINGFIELD, MASSACHUSETTS

CIRCLE INFORM-A-GRAM KEY NO. 93

PRESCRIPTIONS FOR PRODUCTION

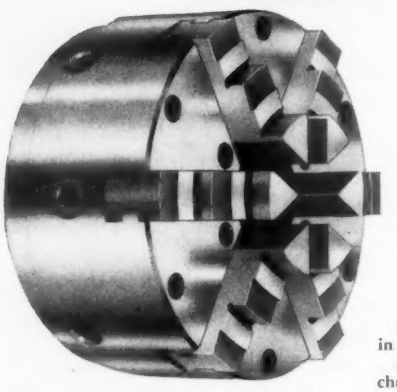
Versatility in a heat-treat furnace is hard to find. Surface Combustion's Allcase batch type, radiant tube heated furnaces provide for high production controlled atmosphere processing—gas carburizing, hot oil or marquenching, clean hardening, dry cyaniding or carbonitriding, carbon restoration, homogeneous carburizing, and clean annealing. Furnace is designed for one-man operation.

Added mobility has been given X-Ray Testing by the introduction of a 65-pound bantamweight unit, the Tri-Ind-X. This complete transformer and tube head assembly is designed to operate continuously at 260 KVP and 10MA. It is equipped with a small focal spot, side emission (35° cone) tube; voltage selector and stabilizer; and many other features.

YOU SAVE

Every Time You Use

Buck



AJUST-TRU Pat. No. 2639157

CHUCKS

This is the only universal scroll chuck with .0005" precision. It is used on lathes, grinders, dividing heads, screw machines. Does most of work formerly requiring stub arbors, mandrels, special fixtures.

6 JAWS

3-jaw and 6-jaw models in 4", 5", 6", 7½", and 9" sizes. 2-jaw Aviation chucks, for holding odd shaped parts in 6", 7½, and 9".

OR 3 JAWS

Save machinists' time — lines up dead true in *one* minute, without shims . . .

Save operators' time — holds .0005" rechucking precision on duplicate parts . . .

Save collet and step-collet costs — the AJUST-TRU does the work of hundreds of dollars worth of collets . . .

Save distortion on tubular work . . .

Save scratches on ground, polished, work . . .

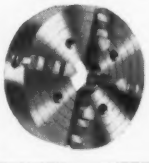
Save time and expensive holding fixtures on many grinding operations . . .

Save chuck wear—it takes up wear in use . . .

More than ever today, you need the economies of Buck chucks. Send for latest catalog.

BUCK TOOL COMPANY

118 SCHIPPERS LANE • KALAMAZOO, MICH.



NEW **SUPER-GRIP 4-JAW**

INDEPENDENT CHUCK FOR 9" to 16" LATHES

Most chucks for 9" to 16" lathes are either too light and cheaply made to hold work securely, or too heavy for the lathe and clumsy to handle. Here's the happy medium — a chuck with ideal weight, providing much more "holding power" from its ⅛" larger diameter, finely threaded screws. Also eliminates ⅜" overhang . . . improves accuracy . . . permits heavier cuts. 6", 8" and 10" models. Send for latest catalog.

CIRCLE INFORM-A-GRAM KEY, NO. 94

Higher rates of metal removal often introduce a new problem—that of chip removal. Practically any high production, horizontal spindle machine tool can be equipped with a continuously operating, automatic Chip-Tote. Scrap material, wet or dry, is funneled into the unit's conveyor belt and carried horizontally until clear of the machine's working mechanism. Scrap is then carried up a steep incline for discharge onto carry-off through conveyor or into tote box. Operating speed can be synchronized with metal-removing rate of the machine tool.

Uninterrupted curtain of water in paint spray booths is assured by sump use of Turquo Liqui-Floc, a low-foaming material that breaks any type of paint into curds which eventually float to the top in a spongy mass. Prevents paint pigments from sticking to waterwall, hydraulic equipment, or other metal surface.

Uniform paint spraying at low cost is promised by newly introduced Ionic Gun equipment. Paint is electronically charged within the spray apparatus itself, eliminating the need for external screens to ionize the paint. Electrically charged paint particles are attracted to the workpiece; overspray and paint loss is minimized. Remote control units and gun design provide great flexibility in automatic conveyorized coating of diversified products.

The Ransburg No. 2 process of electrostatic spray painting functions similarly. The spray gun features a bell-shaped atomizer. A pump unit supplies paint through the hollow drive shaft of the atomizer, and rotation feeds the paint uniformly through the atomizer to its outer edge. Atomization occurs under the influence of an electrostatic field set up within the bell, producing a spray pattern of electrically charged particles. Electrical attraction pulls the spray to the grounded workpieces. No compressed air is used. No water-washed walls or conventional booths are necessary.

Deburring and grinding or polishing of relatively flat small pieces, such as hand tools and typewriter or gun parts, is being done economically on a high production basis using the Curtis "600C" Straight-O-Matic. Work is loaded onto a horizontal conveyor belt that carries it under and against a fast-moving abrasive belt. The abrasive belt is driven by a large diameter roll mounted on a vertical axis above a smaller roll, which provides the grinding pressure against work passing below it on the conveyor belt. The abrasive belt moves in direction opposite to that of work feed.

PRESCRIPTIONS FOR PRODUCTION

Chevrolet at Tonawanda is understood to be the recipient for one of Detroit Testing Machine Co.'s most recent developments. An automatic shaft Brinell machine built for an automated line setup will require no operator. A belt conveyor feeds crankshafts to the spool-like machine. V-notches, in the outer periphery of the spool ends, are faced with Stellite wear inserts. These V-notches pick up one shaft at a time. Weight of the shaft in the load station actuates indexing of the spool carrying the shaft to the second station where a clean spot is ground on the front end of the crankshaft. At the next indexing, a Brinell indenter at the third station comes into play. At the fourth station, the shaft is unloaded onto a table for complete visual inspection of the forging. The 95-lb. crankshaft forging (for 6-cylinder car) is handled by this machine at the rate of 420 pcs/hr. Jamming stops the machine automatically.

Oil can be removed from Oilite bearings, when necessary for impregnation with special lubricant, by soaking in an active oil solvent—clean gasoline, alcohol, or carbon tet—for 30 minutes minimum. Bearings are then dried by evaporation or heating.

We've heard a lot about abrasive belt finishing of cemented carbide cutting tools, also high speed steel tools; but, we hadn't fully realized that the Hammond Carbide Belt Finisher has several little-mentioned but outstanding features. The case of face grinding vs. peripheral grinding has been well stated by every carbide expert over the years. The Hammond machine eliminates the disadvantages of peripheral grinding by running the belt over three rolls, with a carbide-faced platen back of the straight vertical section of the belt run. When grinding, the tool is presented to the belt moving down over the face of the platen; this permits firm uniform grinding pressure, and flatness of top and side faces of the tool. Wax "stick" coolant is used. A range of abrasive grits is available; however, a 150-grit silicon carbide belt has proven of greatest value for a majority of jobs. The machine provides a simplified method of adjusting belt tension, and pulleys or rolls automatically center the belt.

Tube fittings that are installed without disassembling have been introduced by Weatherhead. The self-aligning flareless fitting is quickly installed with no danger of dropping the sleeve and no danger of alignment. A dual sealing effect is achieved—surface to surface, and line to line.

Pre-plating processing of metal parts can now be done completely in a single, compact automatic unit. The Ransomatic drum or cabinet type machine brings the solutions to the work, and with one handling processes the work through washing, pickling, neutralizing, and intermediate rinsing. Each operation is independently time-adjusted.

For greater flexibility, versatility, and economy in selective heating operations, a compact Flamatic Power Control Unit offers full control of fuel gas, oxygen, water, and electric power. Unit permits the use of simple tooling and facilitates fast change-over and automatic operation of one to six fixtures. Spot spin and progressive hardening, or combination hardening and brazing . . . each done simply and efficiently.

LOOK FOR THESE FEATURES IN DRILL JIG BUSHINGS
EX-CELL-O
HAS THEM ALL
MATERIAL..premium grade tool steel selected for greatest wear resistance.
FINISH..precision ground inside and out, and under the head for perfect bearing.
CONCENTRICITY..assured by grinding on arbors after the holes are finished.
HARDNESS..hardened to 62-64 Rockwell "C" on accurately controlled equipment.
UNIFORMITY..of material, dimensions, finish, and hardness.
PROMPT DELIVERY..from stocks of standard sizes in Detroit, New York, Los Angeles, and Toronto.
REPUTATION..largest bushing users in the country are Ex-Cell-O customers.
Ask for Bushing Catalog No. 35936.
XLO
EX-CELL-O for PRECISION
EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

CIRCLE INFORM-A-GRAM KEY, NO. 95

"When and How" Are Top Problems in Machinery Buying

Industry's real problems in replacing machinery and equipment are when and how to buy, rather than what to buy, the president of the nation's largest industrial financing firm has asserted.

According to S. D. Maddock, president of C. I. T. Corporation, replacement too long deferred creates too great a gap between installed capacity and capacity which would be possible with new machinery. However, replacements made too soon are uneconomical since technological advances in machinery over a short period of time are minor.

"Industry must decide when replacement is economically justified and when failure to replace machinery would weaken competitive standing."

"When the decision is made to replace old machinery or to expand or modernize facilities and equipment, it is important that management decide how to finance the program without impairing working capital. When a program is considered which would strain current funds, the practical answer to the problem is to use outside capital which can be repaid over a period of time. The most desirable solution is a funding plan which would leave working capital liquid and permit machinery to pay for itself out of increased earning capacity.

"In general, industry has available three sources of credit: a short-term bank loan; limited credit from several machinery and equipment makers; or a term-loan from an industrial financing company.

"Usually, the first source is used for short-term working capital loans rather than equipment loans. The second source, credit from manufacturers or distributors, is generally used when equipment purchases are made in limited amounts.

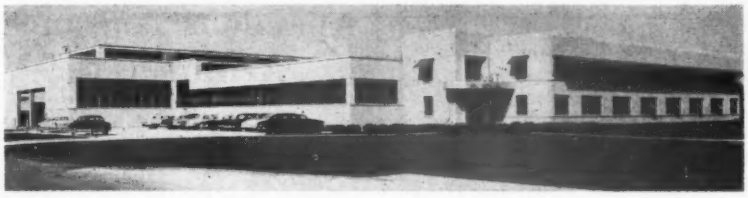
"For major expenditures, the best arrangement is an equipment-funding loan from a firm which specializes in industry financing. Terms can be geared to the borrower's income and tailored precisely to his needs.

"An advantage in this arrangement, is that a firm can make a number of purchases from several different sources and combine them all into one obligation which can be retired through a series of monthly payments. When notice is received from the various suppliers that the purchases are ready for delivery or have been installed, a check from the financing firm concludes each purchase.

"Term loans from the industrial financing company, do not interfere in any way with management, which has unhampered use of additional funds while keeping working capital free for current uses."

Correct MISALIGNMENT
with the ERICKSON FULL FLOATING HOLDER
MODEL 189
COLLET TYPE
(illustrated)
gives both
PARALLEL ADJUSTMENT
and ANGULAR ADJUSTMENT
With the Full Floating Holder, another of the Erickson family of Precision Holding Tools, work and cutting tools may be quickly and easily adjusted to offset machine errors.
This Precision Holder compensates for both parallel and angular misalignment with the work spindle through the use of mechanical principles never before utilized in any floating holder.
Designed for floating reamers, taps, die-heads and all other chuck-held cutting tools, the versatile Erickson Full Floating Holder will help you increase production, reduce scrap, and lower tooling costs.
A-6094
Available in Taper, Bushing and Erickson Collet Types
Write for Catalog Today
Catalog A: Precision Collet Chucks
Catalog B: Adjustable and Full Floating Holders
Catalog C: Precision Tap Chucks
Catalog D: Speed Chucks and Air Operated Cylinders
Catalog E: Precision Expanding Mandrels
Catalog F: Speed Indexers
Catalog G: Boring and Reaming Tools
Erickson
ERICKSON TOOL COMPANY
2314 S. HAMILTON AVE. CLEVELAND 14, OHIO

Brust Tool Opens New Plant to Expand Services



To provide expanded facilities for the design and development of production tools, Brust Tool Mfg. Company has opened a new plant in Franklin Park, (Chicago suburb), Illinois.

With the opening of the new plant, I. M. Brust, president, announces a four-point service with James Carroll, executive vice-president, in charge of operations. This expanded service includes design and engineering; special custom-built high-production machinery; tools and dies; and a production service on precision parts and products.

The company was founded in 1917, by the late Anton A. Brust, pioneer of tools for mass production techniques. Mr. Brust is well remembered for his contributions in the appliance, farm equipment, automotive and aircraft industries.

Industrial Experts to Address Chicago Factory Conference

Fifty-seven experts, drawn from all industries, will address the Plant Maintenance & Engineering Conference, to be held in Chicago, concurrently with the Plant Maintenance & Engineering Show, Jan. 25-28. The conference will take place at the Hotel Hilton and the show at the International Amphitheatre.

Get the information YOU want conveniently and quickly — use a TOOLING and PRODUCTION INFORM-A-GRAM Card — page 131.

The exposition this year is expected to be the largest ever held in the field. Thousands of new products will be shown. The show is now among the five largest annual industrial shows held in the country. L. C. Morrow, consulting editor, "Factory Management & Maintenance," will be general chairman.

Highlight of this year's conference will be a panel headed by 16 speakers at the close of the proceedings at which an effort will be made to answer all previously unanswered questions. Eight industries, chemical, brewing and distilling, food processing and packaging, paper mills and paper products, petroleum refining, sheet metal, steel mills and textiles, will receive special attention.

Advance registration cards for both show and conference may be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

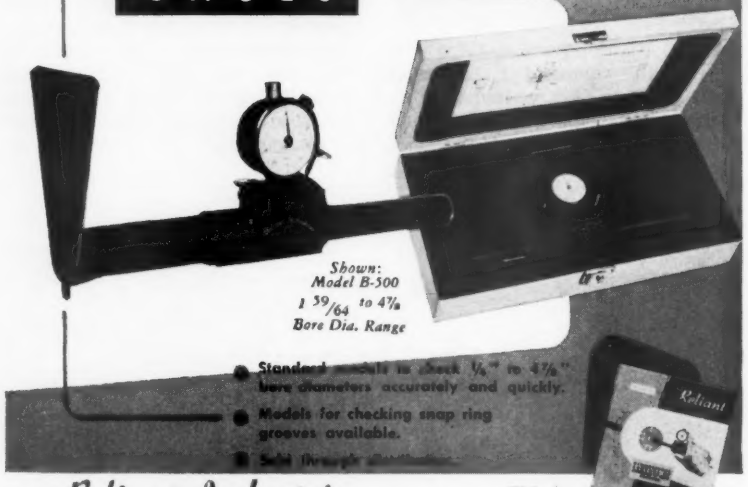
Specify Morton
FIXTURE CLAMPS and COMPONENTS
DEPENDABLE . . . . DURABLE
FIXTURE CLAMPS—widest range, in the industry, of sizes and types to fit every requirement.
Jack Locks . . . Cam Locks . . . Hand Knobs . . . Hand Wheels . . . Steel Ball Handles . . . Soft Chuck Jaw Blanks . . . Fixture Cams . . . Set-up Studs . . . Rest Buttons and Rest Pads . . . Spherical and Plain Collar Nuts . . . Quarter Turn Screws . . . Fixture Keys . . . Spherical and Flat Washers . . . Shoulder Screws and many other items. Complete assemblies or individual parts.
MORTON MACHINE WORKS
Write for Catalog of most complete line in the industry. Full size tracing templates of each product. Economize with MORTON.

CIRCLE INFORM-A-GRAM KEY NO. 97

. . . FOR DIMENSIONAL CONTROL OF INTERNAL "O" RING GROOVES

Reliant GROOVE GAGES

- Checks out-of-round, spherical radii—recesses.
- Use a dial bore gage; blind holes—taper.
- Low in cost.



Shown: Model B-500 1 39/64 to 4⅞ Bore Dia. Range

- Standard models to check ⅛" to 4⅞" bore diameters accurately and quickly.
- Models for checking snap ring grooves available.
- Solid through [illegible]

Reliant Industries
4947 Firestone Boulevard
SOUTH GATE, CALIFORNIA

Write for complete Catalog 53A

MANUFACTURERS OF PRECISION GAGES

CIRCLE INFORM-A-GRAM KEY, NO. 98A

NOW increased production and long life . . .

with "HARD-BUSHED"

DESTACO TOGGLE CLAMPS

This is *new*—Destaco's new clamp design which gives you *hardened* bushings in all series 210, 220, 228 and 240 toggle clamps. The new bushings run full length through the clamp bars for a *larger* bearing surface—and they're deeply serrated to lock in position with no chance of turning in the bars. You get a minimum of wear, smooth, accurate snap action, even under tough production conditions. A feature of our heavier series for some years, this development sets new standards for tooling requiring 500 to 800 lbs. pressures. Further improvements have been incorporated in the "wrap around" construction which strengthens the base.

For any fast clamping action in milling, drilling, welding, bonding, molding, riveting or bolted assembly operations—specify Destaco Toggle Clamps for pressures up to 4000 lbs. Consult our stocking representatives in your area, or select from our 36-page catalog describing over 45 models. Write for his name and your copy today.

DESTACO DETROIT STAMPING COMPANY

344 Midland Avenue • Detroit 3, Michigan

CIRCLE INFORM-A-GRAM KEY, NO. 98B

Holo-Krome Abandons "Nuisance Arithmetic"

Net pricing is the latest innovation to be introduced to the screw fastener industry by the Holo-Krome Screw Corporation of Hartford, Conn. The new system will become effective on or about January 1st, according to an official announcement issued by the company.

In adopting a policy of invoicing its Industrial Distributors at net prices, Holo-Krome believes it is filling a long-felt need and claims to have the enthusiastic support of many leaders in this field. It is expected that Holo-Krome's distributors will, in turn, use the new system in invoicing industrial consumers of the firm's products.

WATCH FOR IT! DON'T MISS IT!

Coming Next Month

TOOLING AND PRODUCTION'S

5TH ANNUAL CARBIDES FEATURE ISSUE

The principal advantage of net pricing lies in its savings of time and effort. It completely eliminates what has often been referred to as the "nuisance arithmetic" which invariably goes with calculating net prices by subtracting discounts from List Prices. Under the new system, these discounts are already deducted from the Holo-Krome List Prices and the resulting Net Prices are invoiced to the customer. Discounts and deductions are figured from List Prices established by Holo-Krome in 1950 and the company announcement emphasizes that the new invoiced prices represent a change in pricing policy only.

Holo-Krome's net prices have been published in two booklets, —one intended for the use of Industrial Consumers, the other to be used by the firm's own Authorized Industrial Distributors. Each booklet gives Net Prices for all standard items in the Holo-Krome line and includes simple directions whereby the original List Prices may be determined from those given.

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Well, teenagers like this know the value of all the parts and personnel of a typical business organization. They're real businessmen and businesswomen on a small scale—forming their own company, floating stock, manufacturing their own products, keeping books, conducting advertising and promotion . . . and distributing dividends.

Long before they leave school, they'll be well acquainted with the business methods that have contributed to our prosperity. They'll have learned, first hand, what makes our economy tick—through Junior Achievement!

Sponsored by a long list of America's leading business firms, Junior Achievement gives young people a chance to experience—under the guidance of successful business men—the ins and outs of a commercial venture before they enter the adult business world. They're shown how enterprise and hard work turn into actual cash.

Because it's training in the ways of American free enterprise—because it's an answer to the youth-indoctrination programs of other ideologies—Junior Achievement is a positive step toward a bright economic future for this country.

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INDUSTRIAL NEWS

An exact duplicate of the die casting machines which turn out large quantities of castings for automobiles, aircraft, household appliances and office equipment has been presented to the College of Engineering at Cornell University. The donor is National Lead Company's Doehler-Jarvis Division. Presentation was made by Joseph A. Martino, company president, and Frank J. Koegler, a National Lead vice-president and general manager of Doehler-Jarvis Div.

Cornell University is the fifth institution to receive such a machine under National Lead Company's Doehler-Jarvis Division University Program, the others being Massachusetts Institute of Technology, Renssalaer Polytechnic Institute, Case Institute of Technology and Illinois Institute of Technology.

The machines are utilized in college engineering and metallurgical departments to illustrate technical know-how for the classroom. In addition to the die casting machines, Doehler-Jarvis furnishes materials and arranges periodic visits from engineers and scientists.

At Cornell the machine has been installed in the Foundry for use by the School of Chemical and Metallurgical Engineering.

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Portelvator® employs an exclusive mechanical lift principle based upon power transmission through meshing worm, worm gear and screw. Load capacities to 20 tons. Stationary or portable. Power operated or manual. Push button controlled or completely automatic. Vertical movement to 10 ft. Table sizes to suit requirements. Tilt tops. Flat tops. Roller tops. — Take another look at your operation . . . and at Portelvator. Write now!
THE Hamilton TOOL COMPANY
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Cyril Bath Company. The new two-million dollar Cyril Bath Company Plant, architecturally designed to foster the "family craftsman theme" in American production, held its Preview Opening recently.

Designed to make the most effective use of space and light, the Company's new plant is located on Aurora Road, Solon, Ohio, about 20 miles southeast of Cleveland. According to Mr. Cyril J. Bath, president of the Company, "The lighting and appearance of the plant is in accordance with an artist's approach to his craft, for the people who make machine tools are artisans."

Comprising 50,000 square feet, the new structure takes up only one-fourth of the 18 acres purchased by the company. Twelve acres of the site are being landscaped and some will be made into an employee recreational area. The plant is located 200 feet back from Ohio Route 43, to allow for trees and lawn.

The new plant incorporates many modern concepts of industrial architecture. The one-floor steel frame building houses factory, general and executive offices. The windows are horizontal "vision strips", admitting daylight with a minimum of sun glare; fluorescent lighting supplements natural light throughout the building.

The factory area has been carefully laid out by the architects to facilitate an orderly flow of material and operations. Eight overhead rail cranes handle up to 25 ton loads. A railroad spur runs directly into the plant so that freight cars can be loaded or unloaded by crane inside the building in any kind of weather. An outside storage area is similarly served by overhead rail crane.

The nation's newest tool used in building jet planes, the recently announced Bath Radial Draw Former, will be manufactured in the

INDUSTRIAL NEWS

new Cyril Bath Company plant. The Radial Draw Former, consisting of a huge rotating table and two hydraulic rams, stretch forms the toughest new metal alloys needed for jet engines.

★ ★ ★

S. C. Johnson & Son, Inc. A metal-working lubricant school to provide instruction in wax lubricants has been established by S. C. Johnson & Son, Inc., makers of wax products, at the company's Racine, Wisconsin, headquarters.

The Johnson school, believed to be the first of its kind in America, was created to train salesmen of Johnson's distributors in the fundamentals of wax chemistry and in the use of Johnson's new wax cutting fluids and lubricants.

The current Johnson training program consists of a series of three-day courses under the direction and guidance of Johnson's lubricant engineers and technicians.

Each course comprises a number of illustrated lectures in a specially-built classroom and laboratory demonstrations in Johnson's Technical Service Department machine shop.

The curriculum consists of lectures and demonstrations in the properties of wax and its use in metal forming, cutting and machining, and piercing and blanking. The proper methods of cleaning are also covered.

In the demonstration portion of the course the superiority of wax in cooling and lubrication are dramatically shown by switching from the standard type cutting fluid to Johnson's Wax-Cool during a lathe cutting job. The standard-type cooland left burnt chips while the wax coolant chips remained clean and cool. Demonstrations are also made on an instrumented test press, a surface grinder, a tool grinder and a drill press.

J. Ralph Edwards, General Sales Manager, Machine Tools, of the Hanson-Whitney Division of Whitney Chain Company, has announced the appointment of Giebel, Inc. as exclusive Sales Representatives for the Hanson-Whitney line of machine tools. Under this appointment, Giebel, Inc. will represent Hanson-Whitney in the territory comprising Connecticut, New Jersey, Eastern New York. The headquarters of Giebel, Inc. is located at 250 W. 57th St., N. Y.

★ ★ ★

The appointment of Stout & Loman as representatives for the state of Indiana has been announced by D. Lee Bassett, vice-president and sales manager of the S-P Mfg. Corp., Cleveland, Ohio.

Stout & Loman have offices at 712 Sycamore St., Kokomo, Indiana. They will be exclusive sales representatives for all of Indiana except Lake and Wayne counties for the S-P line of power chucks, rotating and non-rotating air cylinders and hydraulic cylinders.

TO GEAR MANUFACTURERS Exclusively

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if you have trouble meeting precision tolerance specifications.

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For the generation of spur gears and pinions only.

Capacity: 2" O.D. of workpiece.

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Hobs spur and spiral gears, worm gears and worms (to three thread), splined shafts, gear sectors, and pinions.

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HAMILTON No. 1-B

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Capacity: 6" O.D. of workpiece (3" O.D. by 3/16" face, for bevel gears.)

Exclusive Greater range of hob spindle speeds: 109 to 1259 R.P.M. — 12 speeds.

Exclusive Speed, feed, indexing. *Each can be selected independently.* This, and wide range of hob speeds, adds flexibility; reduces set-up time; gives quick selection of speed and feed to suit material and gear size.

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Exclusive Generates gears from 3 teeth to 1200 teeth.

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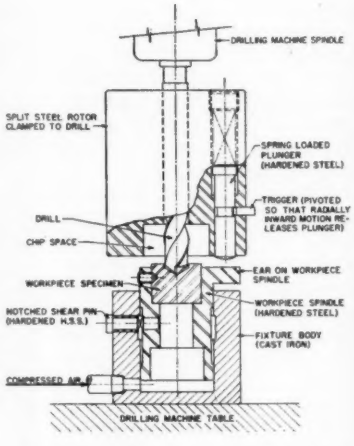
BASIC MECHANICS OF DRILLING METAL

A MAJOR CONTRIBUTION to the "science" of chip removal is in the making at National Twist Drill & Tool Company of Rochester, Michigan. The first progress report on a continuing fundamental research in the drilling of metals was made last month by Carl J. Oxford, Jr., National Twist's research engineer, who presented a paper entitled "Basic Mechanics of the (Drilling) Process" at the 1953 Annual Meeting of The American Society of Mechanical Engineers.*

Whereas previous investigations have been concerned principally with important external effects of drilling—torque, thrust, and drill life as influenced by drill geometry, speeds, feeds, work material, and coolants—the current study is concerned with the mechanics of the actual cutting operation which takes place along the cutting edges and under the chisel edge of the twist drill.

The author cautions that no firm conclusions have yet been reached; the first phase of the research was devoted largely to developing techniques for "observing" the cutting phenomena at the drill point and for obtaining chip specimens. It should be recognized, however, that a substantial amount of the foundation has thus been laid for the further development of drill design and for the scientific control of the many variables that add up to productive or non-productive drilling. It is reasonable to expect, for instance, that the successful application of cemented carbides to twist drills for drilling of steel may now be within practical reach of all.

In order to explore the cutting action of the twist drill, it was necessary to devise a technique which would permit examination of drill chips in the process of formation. The technique developed involved the apparatus shown.



In operation, the workpiece is drilled until the predetermined hole depth is reached. Then the trigger on the side of the rotor is struck lightly. This releases the spring-loaded plunger so that it strikes the protruding ear on the workpiece spindle, causing the shear pin to break and permitting the workpiece spindle to instantaneously accelerate to the

*Paper No. 53-A-167, presented here in part through the courtesy of The American Society of Mechanical Engineers.

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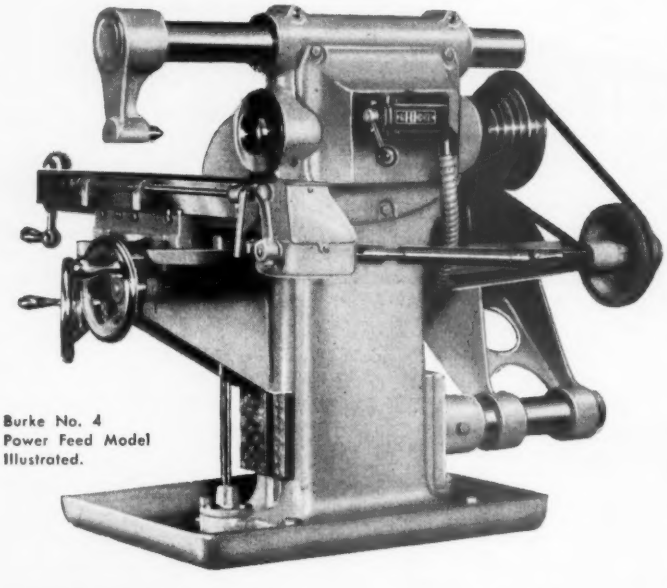
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drill speed. At the same time, the drill-press motor is stopped and the spindle quickly coasts to a stop. This rapid stop of the relative motion between drill and workpiece serves to freeze the action; and, when the drill has been carefully screwed out of the hole, perfectly formed chips are left attached to the bottom of the hole.

To observe chip formation along the cutting edges, it was necessary to section the specimens along planes crossing the chips in the desired direction. To protect chip edges in doing this sectioning, it was necessary that the chips in the bottom of the hole be first given protective hard coating. A nickel plating, using a catalytic chemical reduction process, was employed.

Study of the resultant specimens taken normal to the plane perpendicular to the drill axis showed that, as expected, the chip formation mechanism along the cutting edges (lips) of a twist drill appear to be basically the same as for any other metal-cutting operation. Specimens showed clearly the shear zone, the more elevated direction of crystal elongation, and a small built-up edge. When coolants were used, chips generally were thinner and the character of the built-up edge was changed.

Study of specimens taken normal to the chisel edge confirmed the assumption that the action occurring under the chisel edge of a twist drill is quite complex. Photomicrographs revealed, slightly off center, a severe built-up edge acting to make the effective cutting rake more positive, and a segmental chip sliding up over the built-up edge. Part of the deformation in the segmented chip is probably due to the wiping of the cutting edge.

Sections normal to the chisel edge under the exact center of the drill, where the only tool velocity is of the tool feed in an axial direction, shows a deformation of the work material similar to that caused by an indenting punch. To either side, the deformation becomes more complex and more severe, due to the combination or rotational and feed velocities.

The study of sections made through the workpiece was supplemented by direct visual studies made using a high power (80x) stereomicroscope. As far as can be determined, there is an actual chip formed by the chisel edge. It appears that, when this chip fills the space between the drill clearance surface and the bottom of the hole, it is wiped or extruded toward the cutting edges of the drill. When this chip is forced into the flute space of the drill, it is usually (in the case of steels) plastered about the apex of the generally conical chips produced by the flute cutting edges and is carried off with these chips. Sometimes, part or all of the chisel-edge chip actually turns over the edge of the flute and is ejected in the form of a separate highly deformed ribbon-like chip.

Another accomplishment of the investigation was the development of an effective method for determining the direction of chip flow. This was essential to the proper orientation of chip sections. It was found that chip-flow angle varied widely along

. . . *Continued on page 106*

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HOVIS
OFFERS YOU THIS SIMPLE, UP-TO-THE MINUTE METHOD
There's no need to make a complete new Die for any type washer or blank. The HOVIS UNIVERSAL WASHER DIES provide a Master Holder and by merely changing 5 SMALL, EASILY REMOVABLE PARTS the new washer or blank is produced . . . Special sets of parts are available for use in Master Washer Units enabling customers to produce irregularly shaped pieces and shallow draws. Multi-Washer Dies are also designed and manufactured.
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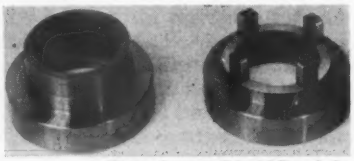
2-Step Broaching Produces 280 Transmission Gears Per Hour

Using a single ram broaching machine with a hydraulic indexing fixture, a leading automaker produces 280 automatic transmission parts per hour at 85 per cent efficiency. The part is a front oil pump drive gear for an automatic transmission and the operation consists of broaching four tangs, 0.340-0.350-inch wide out of AISI G 1117 steel as shown in Figure 1. Depth of the four slots broached is 0.431-inch.

Two operations are required to form the four tangs on a single ram broaching machine. Four parts are broached at a time on a two-sided fixture with one side being loaded and unloaded during the broaching operation on the opposite side.



Photos Courtesy Colonial Broach Co.

Fig. 1. Blank for transmission front oil pump gear (at left) has four tangs broached on single ram machine in two-step operation. Tangs are 0.340-0.350-inch wide and 0.431-inch deep.

While two blanks are having their first pair of diametrically opposite tangs broached in the two center positions on the fixture (Figure 2), two others are simultaneously being completed in the two outside positions. To prevent distortion or springing of the tangs during the broaching operation, back-up bars are mounted vertically on the face of the part holding fixture.

The fixture is then indexed hydraulically 180 degrees, the two outside parts unloaded, the two partially completed gear blanks moved to the outside positions and two new blanks placed on the two center work holders. The unloading of the parts is facilitated by an automatic parts ejector which ejects the parts after each index. To insure that all four tangs are properly spaced 90 degrees apart, hinged locating arms at the outside of the fixture line up the tangs broached in the first operation for the second cut.

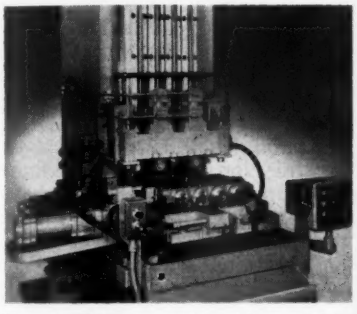


Fig. 2. Single ram broaching machine with fixture used for producing automatic transmission parts. Center positions are used for forming the first two tangs and the outer positions complete the job. Small vertical metal bars provide backing for the blanks during broaching and prevent distortion or springing of the finished part.

During the broaching operation, the gear blanks are held in position by means of overhead hydraulic cylinders with equalizers, one cylinder for each two stations. To hold the blank in position while the entire fixture in being indexed, each work holding stub is machined with a close enough tolerance to keep the blank in position.

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BUY SAVINGS BONDS

Good Housekeeping at Monarch

Using the "surprise factor" usually associated with the unscheduled visits of bank examiners, The Monarch Machine Tool Company, Sidney, Ohio, has just launched a good housekeeping drive to keep its recently enlarged plant in apple-pie order.

Even the general foremen from whose ranks the plant inspection teams are to be drawn each week won't be notified of their respective assignments until the very last moment.

All that will be known "for sure" is that (1) two men will compose each inspection team (one general foreman from each shift), (2) these teams will visit and grade the plant's 19 major departments once a week, and (3) the winning "department-of-the-week" will be permitted to display a specially-designed emblem or plaque indicating its superior housekeeping.

A few of the things for which departments will be graded are:

1. General cleanliness of machines and work places.
2. Platforms and pans straight and behind aisle markers.
3. Chains and ropes in places assigned to them.
4. Absence of scrap lumber, rejected parts, etc. in a department.
5. Scraps of paper and other waste in proper containers.

How well each department measures up will be determined by a grading system with the following ratings:

A. Excellent (Floors and machines in very good order.)

B. Good (Department in shape, but needs some improvement.)

C. Fair (An effort put forth, but not followed through. Several areas bad.)

D. Poor (Department in general needs cleaning. No concentrated effort.)

F. Very bad (No effort put forth.)

★ ★ ★

INDUSTRIAL NEWS

Firth Sterling, Inc. has announced the promotion of Raymond J. Zale to Assistant to the Sales Manager, Steel Division. He will assume the responsibilities for the sale and promotion of tool steel products. Until his recent appointment, Mr. Zale was a steel metallurgist at Firth Sterling.

Before joining Firth Sterling, Mr. Zale was employed by Lindberg Steel Treating Co. where he was Plant Metallurgist, and Assistant Plant Manager of their Rochester Division. Following this he was the New York State Sales Representative for Darwin & Milner, Inc.

—— • ——

The Colorado Fuel and Iron Corporation. Production of high carbon spring wire by the Colorado Fuel and Iron Corp. will be raised by about 12,000 tons annually through the addition of new machinery now being installed in the Buffalo, N. Y., plant of CF&I's Wickwire Spencer Steel Division, according to A. F. Franx, president.

Two modern continuous wire-drawing machines are currently being added to the Wire Mill Department of the Buffalo plant, and started operations during the month of August.

These machines embody the latest engineering advances.

Faster ANGULAR SET-UPS
WITH GAUGE BLOCK ACCURACY
MAGNA-SINE

ON angular set-ups the Magna-Sine saves hours of set-up time, provides positive accuracy, holds work securely without distortion.

The Magna-Sine is a quality permanent-magnet chuck mounted on precision hardened and lapped hinged plates. A Table of Constants provided, quickly shows the standard gauge blocks to insert between the plates for any angle—single or compound. Set-ups to gauge block accuracy take minutes, not hours! When closed, the Magna-Sine is used as a conventional magnetic chuck. Thousands are in daily use.

Write for your free copy of the Magna-Sine Catalog which shows all styles and sizes . . . price list is included.

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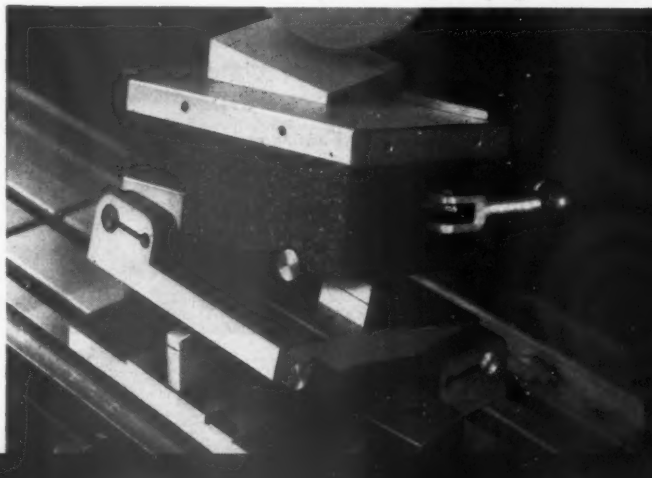
Also producers of special gauges and fixtures



for
GRINDING
INSPECTION
DRILLING
BORING
AT
ANY
ANGLE

. . . Drilling, from page 103

the cutting edge, so an additional study was undertaken to see if chip-flow angle could be related to drill geometry.

With all inclined tools, the effective rake angle is appreciably increased as the inclination angle increases. The relationship exists in the case of a twist drill, but is much more complicated. The effective rake angle varies all along the cutting edge.

It was found that changing the (included) point angle over normal ranges has a relatively slight effect on effective rake angle. except in the region near the center of the drill. Hence, it is probable that the advantage of the long point (98° or less) for abrasive materials is due to the longer cutting edge, and the flat point (133°) is useful on tough materials because the chips are thicker resulting in higher cutting efficiency.

In studying the effect of increasing drill web thickness, it was found that a heavy web showed a consistently higher and more uniform effective rake angle but a lower (or more negative) normal rake than with a regular design drill. The heavy-web drill shows a slightly higher normal rake angle at the periphery, since this drill has a slightly higher helix angle than the regular twist drill. Ordinary drill flute helix angles do not have an appreciable influence on the effective rake angle at diameters less than ½ the basic diameter. The heavy web is also desirable in that it increases rigidity which is helpful in drilling deep holes and tough materials.

The heavy-web drill does have the disadvantage of a longer chisel edge and an increased region involving the resulting rather inefficient cutting process. The longer chisel edge requires higher thrust forces and somewhat increased torque. To improve this condition, the crankshaft or split point has been developed.

The drill is first sharpened in the normal manner, yielding a long chisel edge. Then a second grinding cut is taken on the heel side of the point, parallel to the chisel edge, but inclined at 30 to 45° to the drill axis. These cuts are carried right along to the chisel edge and ground very close to center, so that the web thickness is reduced to nearly zero. This provides two additional cutting edges which can produce fairly conventional chips.

The chisel edge of a drill is nearly flat and, as its length increases, the drill becomes difficult to start unless guided by a bushing to eliminate wandering tendencies. If split-pointed drills must be started without a bushing, it may be helpful to rotate the secondary cutting edges slightly toward the regular cutting edges. This produces a higher center point which easily can be indented into the work material, providing a guide for starting the drill.

The National Twist Drill & Tool Co. has made a commendable start in a systematic and thorough investigation into the art and science of drilling metals. Industry, in the future, will be greatly benefited by the "more science, and less art" that will result from this study.

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WHY WAIT FOR SPECIAL TAPS?

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HIGH SPEED SPECIAL RIGHT HAND TAPS

SIZE	THREAD
4	32-48-60-64
5	30-32-36-48-80
6	30-40-48-56-60
7	32-40
8	24-30-36-38-40-44-48
9	24-28-32-40
10	28-30-36-40-48-64
12	20-28-32-36
14	20-24-28
1/16	60-64
5/64	72
3/32	48
7/64	48-56
1/8	32-40
5/32	32-36-40
9/64	36-40
11/64	36
3/16	20-24-32
13/64	32
7/32	24-28-32
1/4	18-24-26-27-30-32-36-40
5/16	18-20-22-27-28-32-40
3/8	12-16-18-20-27-28-32-36-40-48
7/16	12-16-18-22-24-27-28-30-32-36-40
1/2	12-14-16-18-22-24-26-27-28-30-32-40
9/16	16-20-24-27-28-30-32-40-48
5/8	12-14-16-20-24-27-28-32-36-40
11/16	11-16-18-20-24-27-28-30-32
3/4	9-11-12-14-18-20-24-26-27-28-32
13/16	10-14-18-20-32
7/8	10-12-16-18-20-24-27-28-32
15/16	8-9-10-12-14-16-18-20-24-32
1	10-12-16-18-20-24-27-32-40
1-1/16	12-14-16-18-20-24
1-1/8	8-10-14-16-18-20-24-32
1-3/16	8-10-12-14-16-18-20-24
1-1/4	8-10-14-16-18-20-24-32
1-5/16	12-14-16-18-20-24-32
1-3/8	8-10-14-16-18-20-24
1-7/16	8-10-12-16-18-20-24
1-1/2	8-10-14-16-18-20-24-28
1-9/16	18-20-24
1-5/8	5½-8-10-12-13-16-18-20-24
1-11/16	10-12-14-16-18-20-24
1-3/4	8-10-12-14-16-18-20-24
1-13/16	8-10-12-14-16-18-20
1-7/8	8-10-12-14-16-18-20-24
1-15/16	8-10-12-14-16-18-20-24-28
2	4-1/2-8-10-12-16-18-20
2-1/16	12-14
2-1/8	12-16-20
2-3/16	12-16
2-1/4	4-½-8-12-14-16-18
2-5/16	12-18
2-3/8	12-16-18
2-1/2	8-10-12
2-9/16	18
2-5/8	12-16-20
2-3/4	16
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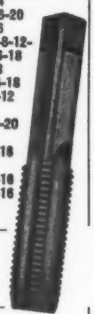
3-7/8	8
4	8-12



HIGH SPEED LEFT HAND TAPS

SIZE	THREAD
0	80
1	56-64-72
2	56-64
3	56
4	32-36-40-48
5	40-44
6	32-36-40
8	32-36-40
10	24-30-32-40
12	24-28-32
1/4	20-28-32
5/16	18-20-24-28-32
3/8	16-24-32
7/16	14-20-28
1/2	12-13-20-28
9/16	12-18-20-24
5/8	11-12-18-20-24
11/16	11-16-24
3/4	10-16-18-20
13/16	16
7/8	9-12-14-18-20
1	8-12-14-16-18-20
1-1/8	7-12
1-1/4	7-12-16-18
1-3/8	6-8-10-12-16-18-20-24
1-7/16	8-10-12-14-16-18-20
1-1/2	6-8-10-12-16-18-20
1-9/16	8-10-12-16-18-20
1-5/8	8-10-12-14-16-18-20
1-11/16	8-10-12-14-16-18-20
1-3/4	8-10-12-14-16-18-20
1-13/16	8-10-12-14-16-18-20
1-7/8	8-10-12-14-16-18-20
1-15/16	8-10-12-14-16-18-20
2	4½-10-12

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Prices on Application We are always adding new sizes

NOTE: Oversize - Undersize - Metric - 64th and 32nd Size Taps Available for Quick Delivery.

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CIRCLE INFORM-A-GRAM KEY NO. 106

. . . Month's Talk, from page 66

My own industry shares this great need, and a considerable portion of our need is for men of your persuasion. We need mechanical engineers because we make things from materials, and because materials and their applications stand high among our most pressing problems. We need mechanical engineers for research and development, for design and production. We need them for new products and devices, and we need them for new developments on old-line apparatus. It may surprise you to learn that we now have about as many mechanical engineers at Westinghouse as we have electrical engineers.

If the first requirement of a national effort in engineering is that we train engineers, the second requirement is the equally obvious one that we use them intelligently once they are trained. We are not altogether doing that. Of the inadequate number of engineers graduating last June, about half were tapped for the armed services. Approximately one-third of the country's engineers have reserve commitments and presumably will be called up for service in an emergency.

I am acutely conscious of the moral and ethical problems involved in deferring our young men of the professions and sciences. Nevertheless, it is against the country's own interest to throw our educated technologists helter-skelter into the armed services, where they will lose several years' training and may be diverted from their professions. These men are one of the keys to our national survival. It has been pointed out that about half the technical personnel in the first atomic bomb project were students when the war began and under 26 years of age in 1945. Consider the cost to us if these young men had been drafted for purely military service!

I have said that wherever our problems are physical and subject to technical solutions, we can achieve whatever we need to achieve—provided we train the technologists and utilize their talents properly. Unhappily, however, many of our most dangerous problems are not physical and will not be solved by better research, higher productivity, or any of the other industrial virtues. I refer to the social illnesses that afflict our age. How to cope with these is properly the most perplexing internal problem we face.

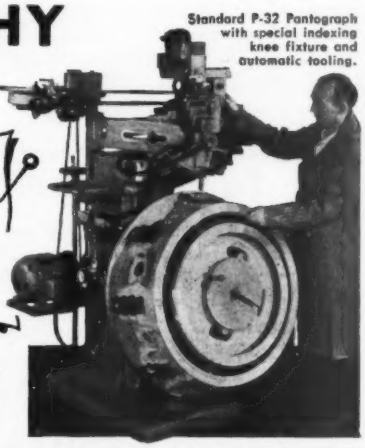
You and other engineers hold part of the answer in your hands. You have successfully applied engineering principles to industry. Now our hope lies in part in the application of those principles to our social problems.

With all possible deference, I suggest that the engineer himself—the man who knows most about the physical facts of our world—should attempt to make that application. I suggest that your people undertake a greater share in meeting the crisis we face. I ask that you help to bring sound and efficient management to government at all levels; that you analyze and attack crime, illiteracy, poverty and slums as you would analyze and attack any major problem in your field; that you act as a catalyst for production action among many groups in order to remedy conditions that are unworthy of civ-

. . . Continued on page 110

PANTOGRAPHY

Solves Complex Profiling Problems with Automatic Cutting Cycle

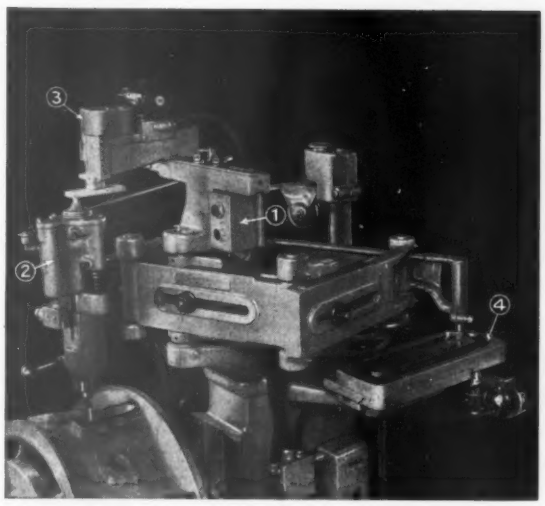


Standard P-32 Pantograph with special indexing knee fixture and automatic tooling.

PROBLEM: Profiling eight ports in outside portion of aircraft part, a large aluminum-alloy casting. The sides of each port are parallel; one end has a true radius, the other end is parabolic.

SOLUTION: Gorton P-32 Pantograph profiles all eight ports at the rate of 2.3 minutes per port. Cutting cycle is automatic; indexing is manual.

This is truly a power-driven tracer-control job that would require hours if done by a combination of other methods.



Here's How It Works

1. Complete cutting cycle begins when "start" button is pressed.
2. Air cylinder automatically feeds cutter down to cutting position. Cam-operated spindle down feed then takes over. Upon completion of cut and after spindle retracts, this air cylinder further retracts cutter for clearance.
3. Speed of spindle down feed during cutting is controlled by cam through a Variac.
4. Motorized chain-driven master starts automatically when "start" button is pressed.

This is just one of many Gorton tracer-controlled production short-cuts which might save you time and money. For complete information, clip and mail the coupon now.

GEORGE GORTON MACHINE CO.

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Please send at once complete information about the Gorton line contained in Bulletin 1655-1201

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City, State .....

CIRCLE INFORM-A-GRAM KEY NO. 107

Metal Borides Development To Be Accelerated

Three well-known companies have united forces to expand the activities of the Borolite Corporation, which was recently formed to pursue research and development of various metal borides ("Borolites") for high temperature military and civilian applications, according to a joint announcement by the presidents of the three cooperating companies — Mr. Kenneth D. Mann, of Firth Sterling Inc., Pittsburgh, Pa.; Dr. Paul Schwarzkopf, of American Electro Metal Corporation, Yonkers, N. Y.; and Major General Clinton F. Robinson, of The Carborundum Company, Niagara Falls, N. Y.

All three companies had previously engaged in separate research and development programs for atomic age materials. The joint statement said the Borolite Corporation was formed to concentrate funds and facilities for faster and broader development of new high temperature materials desperately needed by government and industry.

American Electro Metal Corporation has assigned to the Borolite Corporation all patents, compositions, processes and techniques relating to borolite materials, and will provide research and some pilot plant production for the new company. The Carborundum Company will draw upon its experience with abrasive, refractory, and powdered materials to produce and manufacture various borides. Firth Sterling Inc. has production know-how and equipment for certain powder metallurgy processes, and will fabricate borolite products.

Borides, carbides, and aluminides, all part of the Borolite Corporation's program, show promise of withstanding operating temperatures ranging from 1600°-2000°F. for turbo-jets and up to 7000°F. for rocket nozzles and intermediate applications.

Dr. Schwarzkopf pointed out that while the Air Force supported research on aluminides, the Office of Naval Research, since 1946, has allotted large sums of money for boride research, not only because borides retain a great part of their strength at temperatures in excess of 2500°F., but also because they are composed of non-strategic materials. Civilian uses of borides, which are combinations of boron with such metals as zirconium, chromium, and molybdenum, appear to be in crucibles for melting metals, protector tubes for thermocouples, atomizing nozzles for metal spraying equipment, and electrical contacts — because of the borolites' excellent electrical conductivity, hardness and erosion resistance. Some borolites also possess light weight per unit volume and excellent resistance to oxidizing atmospheres.

In the initial stages the three participating companies will manufacture the borolite products which will be marketed by the Borolite Corporation with headquarters in Niagara Falls, New York.

Get the information YOU want conveniently and quickly—use a TOOLING and PRODUCTION Inform-A-Gram Card — page 131.

To Prove Their Valor
Redskin Warriors
Used Marking Devices

In the Frontier Days, Indian warriors used painted or decorative marking devices to indicate their prowess and to show how many or what kind of coups they had performed.

CADILLAC 115
HAND MARKING MACHINE

GENERAL PURPOSE FLOOR TYPE
HAND MARKING MACHINE

Marks: Flat or Round Parts...Parts of Varying Thickness
Rolling Operation for Marking Requires Minimum Pressure

This machine is ideal for many light marking operations and short run jobs . . . its simple construction permits easy changes from one marking operation to another — thereby reducing down-time. Simple fixtures generally suffice for locating parts to be marked . . . specifications for fixtures can be readily met.

Dangers of distortion and fracture are minimized — pressures reduced to barest minimum because this machine *rolls* the impression into the part.

For full information write for Bulletin L-115

ROLL TYPE HOLDER
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MARKING MACHINE AND PUNCH PRESS HOLDERS
For Interchangeable Type
Made of alloy tool steel, all are furnished with a replaceable platen—hardened and precision ground.

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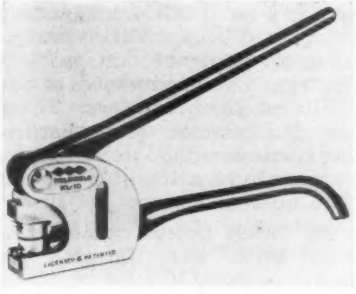
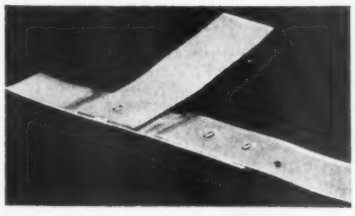
CIRCLE INFORM-A-GRAM KEY NO. 108

First Tool Developed for KOLDWELD Process



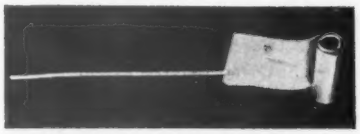
The hand operated tool illustrated here accomplishes the job of lap welding aluminum sheet or foil without heat or electricity and without any kind of flux or chemical.

The method, known as the KOLDWELD process, was announced and demonstrated some months ago with experimental tools. It is applicable to aluminum sheet and foil and the butt welding of aluminum and copper wire. The tool for performing lap welds is the first available. A corresponding tool for the butt welding of wires will follow shortly.



Two welded pieces, each .040" aluminum, (or dissimilar thicknesses) represent the maximum capacity (.080") of the tool illustrated above.

The lap welding tool welds aluminum foil, sheet, shaped extrusions or strip by pressing the surfaces of the parts together between specially designed dies. The manufacturer advises that the tool will koldweld all types of aluminum (except 56S and aircraft qualities in the T temper) and electrical copper in thicknesses of .001" to .040", or a combined maximum thickness of .080". Dissimilar sizes or different metals may be welded. Each thickness of weld requires a different size interchangable die.



A Koldweld of No. 22 aluminum or copper wire to .001" aluminum foil.

The surfaces are prepared for welding simply by cleaning them with a steel wire scratch brush (or similar mechanical action) to remove surface oxidation, dirt and grease. The welds meet the same tests as applied to conventional welds. When the weld is pulled apart fracture occurs around the periphery of the spot, pulling a slug from one of the sheets. The tools weighs about 2¾ lbs. and is normally hand operated in the manner of pliers with only average grip strength required.

A lap weld of .001" aluminum foil.

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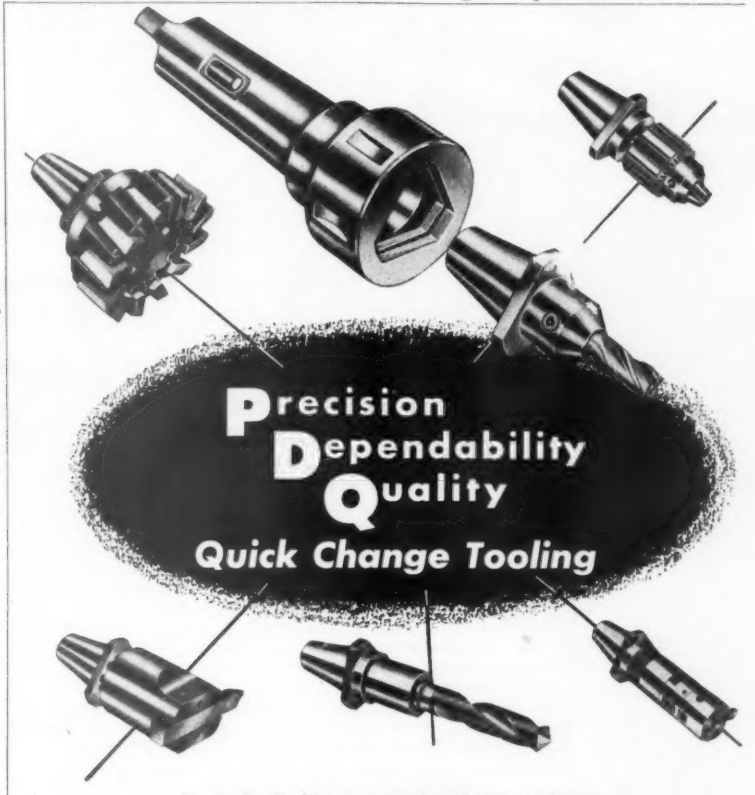
FOR SALE: 22 Dietzen Drawing Tables with drawers and Dietzen straight edges, used, good condition, $60.00 each; 10 Dazor lights, used, good condition, $5.00 each: Good used Machinery—Lathes, Shaper and 2 Mills, Low Price. Paramount Tool & Engineering, Inc., 542 Frenchmen Street, New Orleans, La.



The P. D. Q. (Portage Double Quick) tool holder and adapter line opens a new era in quick change tools. These Portage tools not only mean new speeds in production and set-up time, but increased accuracy as well.

Send for the New P. D. Q. Catalog

PDQ

PORTAGE Double-Quick TOOL CO.

1046 Sweitzer Avenue • Akron 11, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 109

. . . Month's Talk, from page 107

ilized men in the middle of the Twentieth Century.

I do not present this to you as a duty or an obligation, but rather as a challenge and an opportunity. Nor do I offer it as a new idea. I ask you to consider the desirability now of joining with other engineers to give your talents and prestige and integrity to this broader cause—the social and moral improvement of mankind.

In my opinion, the engineer is not only the ideal man for this work, but also stands in an ideal position to perform it. He is everywhere respected for his character, his competence, and his record. He is welcomed by all groups and can talk to all types of people. He might successfully erect a bridge between the technical and the humanistic world, and bring diverse groups together into a common program as no one else is equally capable of doing.

Although he is so admirably fitted for the roles of citizen and public servant, it is my impression that the engineer has tended to stay clear of such commitment. Out of curiosity on this point, I have made a layman's analysis of the civilian professions of some of our political leaders. Of the governors of our 48 states, 28 are lawyers. There are businessmen and pharmacists, salesmen and auto dealers, farmers and editors; but I can find no engineers.

Of the 96 United States senators, seven were farmers, six were teachers, 16 were businessmen, 53 were lawyers. Only two were engineers. Yet there are about 400,000 engineers in this country, and about half as many lawyers.

Now I think the attorney-at-law brings an ideal training to public service. As a member of the bar, and one who served a term many years ago in the Pennsylvania legislature, I am sure I shall not be accused of bias when I say that many valuable talents lie outside the legal field, and that our state capitols and Congress of the United States could advantageously use the services of more engineers. Legislators in this modern world are far more than lawmakers. They must investigate and analyze, manage and appropriate. They must on short notice become experts on airfields in North Africa, hydraulic power installations in the Northwest, cotton-growing in the South, and the foreign trade problems of Japan. The trained engineering mind could bring a rich contribution to all of these jobs and functions. Certainly the Senate career of your own Aalph Flanders bears me out.

Some day, perhaps, the inhabitants of this planet will come to their senses and devote themselves in united human effort to creative good. In such a world, the energies of two and a half billion men and women might be directed at high technical adventure. They might carry out a crash program of wartime proportions against man's enemy, cancer. They might pool their machinery, equipment, skills, labor and capital to improve the backward areas of the earth. Together they could irrigate the world's deserts, including the one-third of our own country that is arid. They might control floods, droughts and storms, and

ARMSTRONG
TOOL HOLDERS
answer both . .
1. The problem of lowering costs
2. The problem of increasing output
By providing permanent, multi-purpose, inexpensive ARMSTRONG TOOL HOLDERS that use cutters or bits that are quickly ground from standard high speed shapes (Saving: All Forging, 70% Grinding and 90% High Speed Steel), the Armstrong System of Tool Holders will reduce your tool cost to an absolute minimum.
By providing stronger, more efficient tools, carefully developed for each operation, as well as ARMSTRONG High Speed Steel, ARMALOY Cast Alloy Cutter Bits or Armide Carbide-Tipped Cutters as required for each job, ARMSTRONG TOOL HOLDERS permit greatly increased speeds and feeds, enable you to increase the hourly output of every lathe, planer, slotter, shaper, turret lathe and screw machine.
There is no surer way to lower costs and increase output, than to use the correct ARMSTRONG TOOL HOLDER for each operation on all machines.
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CIRCLE INFORM-A-GRAM KEY NO. 110

build an international weather station on Everest. They might explore the world under the sea, drill a second five miles into the earth, and see whether that rocket really can be launched from Earth to Moon.

In the eloquent words Winston Churchill spoke to the English Parliament: "The human race, free from the dread of mass destruction, could have the swiftest expansion of material well-being that has ever been within their reach or even within their dreams. These majestic possibilities ought to gleam, and be made to gleam, before the eyes of the populations in every land, and inspire the counsels of all who take responsibility for their guidance."

I am told that man is the only creature of the earth that is still evolving—that all others have died away or are fixed in their characteristics. Our hope and purpose lie in using our genius to speed up that evolution. Nothing less will serve, for we are in a grim race with evil.

It is not enough that you and your fellows have given us the stunning scientific triumphs that have blessed this land in so many ways. You must now decide whether you will not help us to use that science for even better ends. Somehow the nature of man must be made to grow spiritually and intellectually. Somehow our hearts and minds, our morality and our social institutions, must be made to catch up to the technology you have created for us. I say that this must be done, that it can be done, and that you can lead the way in doing it.

—•—

Lake Erie Offers New Packaged Installation

Lake Erie Engineering Corporation of Buffalo, New York, a leading producer of heavy industrial machinery, has just announced a newly created service by which industrial customers can purchase "packaged installations" of complete Lake Erie production equipment, set up in their plant, ready to operate.

As a part of this service, Lake Erie Engineering will survey the customer's hydraulic press or die casting requirements and make specific recommendations. They will design, manufacture, supply and install all the basic machinery, tools and dies, conveyors, loading mechanisms, furnaces and other related auxiliaries. Their field force will install or supervise the installation of the complete equipment in the customer's plant — place the equipment in operation and train the supervisory and production personnel. Lake Erie Engineering will assume the responsibility for the satisfactory operation of the equipment as an integrated plant.

This plan—actually a consolidation of all the specialized services offered by Lake Erie—is designed to eliminate piece-meal purchasing and the resultant divided responsibility. The industrial machinery purchaser gains all the advantages of buying from a central source of supply which assumes all the responsibility for proper installation and operation. "Packaged Installation" provides engineered production facilities that make the most efficient use of time, space, machinery and labor.

Positive Results with VISUAL GRIND
TESTED AND PROVEN SUCCESSFUL!
Progressive Die
Flat Form Tool
Here is precision contour grinding at its best. Steel and tungsten carbide form tools, die sections, templates and related items are efficiently processed in dependable, economical fashion. Our basic magnetic chuck work-holder affords positive positioning yet with flexibility for cam, circular and index grinding with the proper fixtures. Work-piece quality is controlled visually at all stages, either while using pre-dressed grinding wheels or when generating the required contour by means of successive, controlled movements. Durable construction around precision optics insures rigidity and long life.
Circular Form Tool
Blanking Die
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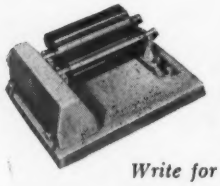
Ask for Bulletin T-1
VISUAL GRIND
THE CLEVELAND GRINDING MACHINE COMPANY
1643 EDDY ROAD • CLEVELAND 12, OHIO
New Possibilities in Optical Grinding
CIRCLE INFORM-A-GRAM KEY NO. 111

Announcing

the NEW 24 inch SPITFIRE FLAT LAPPING MACHINE

LOW COST PRECISION LAPPING AT PRODUCTION SPEED

A NEW, large size Flat Lapping Machine of improved design for precision lapping of any material where a perfectly flat surface is necessary. Extremely close tolerance finishes are possible. An ideal machine for producing mating surfaces of sliding and rotating parts of air and liquid tight seals, plastic and die casting molds.



SPITFIRE ROLLER LAPPING MACHINE

For lapping cylinders to accurate, mirror-like finishes in less time than any other method. Saves up to ⅔ time in lapping.

Write for Brochures, Prices and Delivery

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2935 N. Pulaski Rd. Chicago 41, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 112A

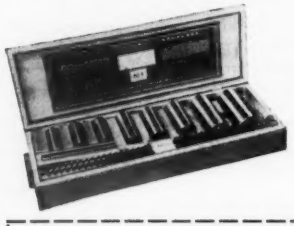
CUT IT OUT!

Cut what out?

any KEYWAY in any of your gears, milling cutters, pulley hubs, collars, couplings — *any* size from 1/16" to 1", in *any* bore from 1/4" to 3"

Cut it out *fast* — sixty seconds per keyway

Cut it out *cheap* — as little as 1¢ per keyway



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CIRCLE INFORM-A-GRAM KEY NO. 112C

Fast-Precision Tapping Made Easy!

Check These VIKING FEATURES

- Cuts tapping time 80%
- Takes jobs up to 18" in height
- Less breakage saves taps
- Needs only unskilled labor
- No vise necessary

The NEW Improved VIKING Tapper

Fast precision tapping made easy with the new Viking Tapper, unskilled help can tap more holes in less time—and the work is more accurate and uniform. For example, a perfect 3/4"—10 hole can be tapped in 3/4" heavy tool steel in one minute. Saves taps too because there is far less breakage. In fact the saving on taps alone soon pays for the Viking Tapper.

Another important feature is extreme flexibility. Unique adjustable arm which can easily and quickly be raised or lowered, swung left or right, takes jobs up to 18" in height and requires less resetting. Sliding parallel bars hold work—no vise needed. Quick changing adapters take only 5 seconds to change taps.

Stand or bench model. Adapters available in eight sizes. Write for full information. THE VIKING TOOL AND MACHINE CORP., 6 Main Street, Belleville 9, N.J.

CIRCLE INFORM-A-GRAM KEY NO. 112B

LEVIN® MICRO-DRILL PRESS

FOR VERY SMALL HOLES DOWN TO .002

Designed to hold small drills in precision collets, thus overcoming the difficulty of making a drill run true as when held in a conventional drill chuck. Absence of a sliding quill guarantees maximum sensitivity with fingertip control. A mounted 1/8" capacity chuck can also be used.

Send for Catalog L describing Micro-Drill Press, full range of collet sizes, accessories and other precision tools

LOUIS LEVIN & SON, INC., 782 E. PICO BLVD., LOS ANGELES 21, CALIF.

CIRCLE INFORM-A-GRAM KEY NO. 112D

Lower Your Die Costs . . .

GET
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FILING, SAWING and
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OLIVER
DIE MAKING MACHINES
PLANTS of ALL SIZES
REPORT SAVINGS up to 60%

Oliver Die Making Machines are so simple to operate that skilled labor is not needed. They increase toolroom efficiency . . . cut costs . . . assure precision perfection. Four decades of experience and more than 10,000 installations throughout the world vouch for the superiority and long life of Oliver Die Making Machines.

Start saving money now. Do sawing, filing and lapping the proved way . . . the Oliver way.

OLIVER DIE MAKERS
Available in 5 Models

The Bench Model S-1 (illustrated) is a single speed die maker for use on tool steel up to 1" thick.

The Heavy Duty Model (illustrated) has 6 speeds, works in metal up to 3" thick, has variable strokes to 5" with hydraulic feed.

Write Today For Complete Technical Data on OLIVER DIE MAKERS

MACHINE TOOLS by OLIVER include:
AUTOMATIC DRILL GRINDERS
TOOL & CUTTER GRINDERS
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OLIVER INSTRUMENT CO.
1436 E. MAUMEE · ADRIAN, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 113A

Reduce Small Drill and Tap Production Expenses

The cost of small drills and taps is far from inexpensive—and down-time, etc. involved in removing broken bits from work pieces compounds their initial cost.

Here is a highly interesting and novel application of a pressure gauge used for reducing production costs caused by breaking drills and taps on drill press work.

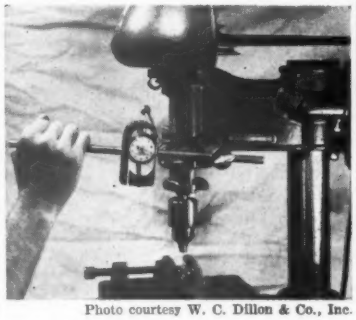

Photo courtesy W. C. Dillon & Co., Inc.

The application is especially useful on repetitive production, and on jobs where the small sizes of taps and drills are used—these being particularly susceptible to breakage by downward pressure.

As can be seen in the photograph, the conventional drill handle is removed and a split handle inserted, with the pressure gauge a part of the handle. Pressure is measured in pounds, and maximum safe pressure for the operation can easily be determined by the shop or department foreman. From there tap and drill breakage caused by too much pressure can be avoided by staying under the maximum prescribed pressure.

Accuracy of the gauge is 1% of indicated reading, plus or minus, and with an overload capacity up to 25% without adverse effect on the calibrations.

If the drill press is needed for other operations not requiring the pressure gauge, the split handle can quickly be removed and the conventional handle used.

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NEWCOMER
Controlled Quality
CARBIDES

for greater Production Economy

From start to finish, NEWCOMER CARBIDES are made in our own plant . . . to high controlled-quality standards.

NEWCOMER CARBIDES are made to give you greater production economy through heavier feeds, faster cutting speeds and greater wear resistance than most other carbides. Complete stocks of standard carbide blanks, cutting tools, and mechanically-held tools are available for ready delivery.

For your particular cutting problem, consult a Newcomer Tool Engineer . . . there's one located near you.

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CONTROLLED QUALITY CARBIDE

NEWCOMER PRODUCTS, INC.
Latrobe, Pa.
General Sales Office:
512 Franklin Ave., Pittsburgh 21, Pa.

CIRCLE INFORM-A-GRAM KEY NO. 113B

. . . Gaging, from page 58

range of measuring coils to suit pitches of 8 TPI to 40 TPI. Each pair of coils is housed in a container marked as to thread pitch. Constants are printed on the container, enabling the user to set the instruments for any size screw by the use of standard gage blocks, Figure 5, thus eliminating costly setting plugs.

This is widely recognized as the fastest means of measuring pitch diameter and of correctly determining the low limit of screw threads. For this reason it is rapidly finding favor in many of the large plants for Receiving Inspection, quite apart from the obvious advantages to be obtained by its use in production.

Observations on the Use of Wire Methods

It must be remembered, however, that there are important considerations to be taken into account when using the wire method. It is possible to have a screw measuring the correct pitch diameter, but if it has lead error, then the screw will not assemble. For this reason, the "GO" ring gage cannot be entirely eliminated, but its use and the consequent wear can be reduced by the following simple procedure.

The effects of lead error can be neutralized by a reduction in size of the pitch diameter; for example, if the Screw No. 1 mentioned earlier, were to be reduced in size, it would then pass into the "GO" gage. This being so, then a proportion of the tolerance should be reserved for the effects of lead error. A fair allowance would be approximately one-fourth of the tolerance down from the high limit. When using O-VEE gages, this can be allowed for by a corresponding deduction from the high limit on the data plate.

In the case of the comparator, this reserve for lead error can be visibly controlled by moving the MAX tolerance pointer down by this allowance of approximately one-fourth of the tolerance, as in Figure 6. Any component coming within this range of one-fourth the tolerance from the high limit should be checked on a "GO" ring gage to detect any possible lead or angle errors.

A few experimental checks with the "GO" ring gage on components approaching this range will determine just how much should be reserved for lead and angle errors. For instance, if the screw threads were of perfect form, then there will be no need for an allowance as the indicator would indicate the high limit and the screw would be accepted in the "GO" ring gage. On the other hand, if there happened to be a bad lead or angle error, then the allowance may need to be a little more than one-fourth the tolerance. For example, the indicator may read halfway between the tolerances and the screw feels snug in the ring gage.

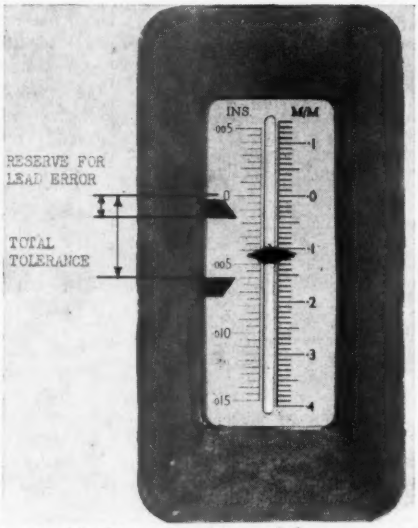


Fig. 6. The MAX tolerance pointer of the comparator scale can be located to give warning of possible lead error.

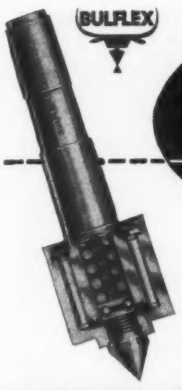
This would be evidence that there was some considerable error in lead or form so the top tolerance pointer should be brought down to the halfway mark and the work controlled between these limits. The low limit, as shown on O-VEE gages or comparators will indicate more accurately than conventional gages the true low limit of pitch diameter. No allowance on the low limit is necessary.

This simplified method will control the variation of any element or any deformation of a screw thread. These variations or deformities could be one or more of the following:

1) Major Diameter high.
2) Root or Minor Diameter high.
3) Angle Errors.
4) Lead Errors.
5) Drunkenness.
6) Out-of-Roundness.

In each case, a component with a moderate amount of any one or all of the above errors can be accommodated in a "GO" ring gage by reducing the overall size of the thread. If by a subsequent check by the wire method or O-VEE method, the component is not undersized, then the screw is satisfactory. If, on the other hand, it is undersized, then the threading tools must be checked to eliminate some of the

. . . Continued on page 119



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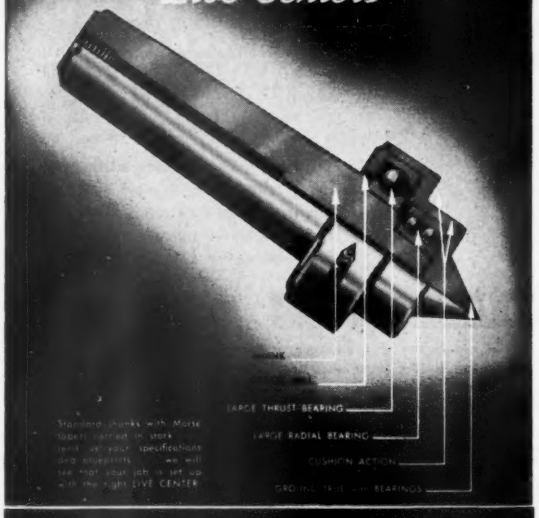

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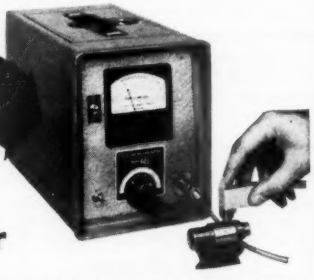

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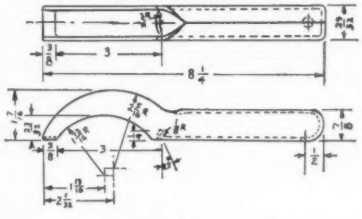
Conversion of Castings to Stampings

In the quest for better production performance and the hopes for a lower cost per unit, manufacturers will quite often compare the cost of castings against stamping and vice versa.

Such a request was made to the Dayton Rogers Manufacturing Company, which concerned converting the manufacture of a spanner wrench from a malleable casting, Figure 1, to a stamping.

After some development layout was made, the final design shown in the sketch was adopted and the wrench shown in Figure 2 was put into production.

This spanner wrench is used for the draw-in attachment on a small popular precision bench lathe. It should be remembered



that the malleable casting required considerable machining and was much heavier than the stamped wrench.

With the introduction of die-cut stampings as shown, not only was a much lighter wrench provided, but it was less expensive and much stronger. It also provided a large selection of desirable materials that could be heat treated and finished in a more satisfactory manner.

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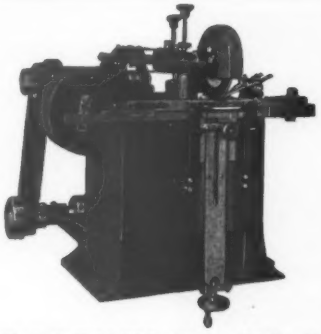

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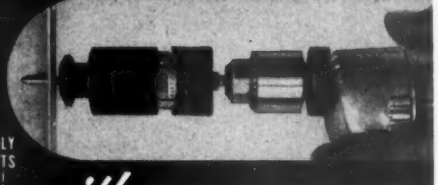

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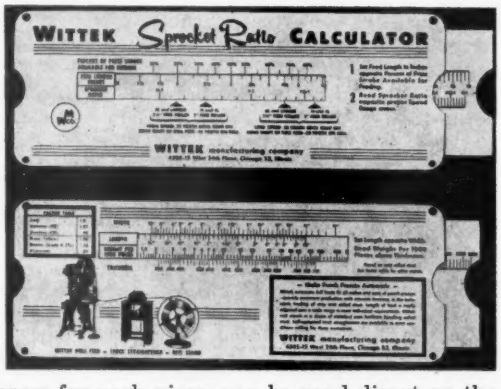
For determining at a glance the correct sprocket ratio to be used on its automatic roll feed for punch presses, the Wittek Mfg. Co., 4305-15 W. 24th Pl., Chicago 23, Ill., offers an easy-to-read, accurate slide rule calculator.

The required sprocket ratio, which determines the rate at which stock is fed to the



press for each piece, can be read direct on the calculator for any combination of feed length and percent of stroke between 1 and 18 inches of feed and from 25 to 80 percent of stroke. This rate, of course, depends upon the length of feed and the percent of the stroke available for feeding.

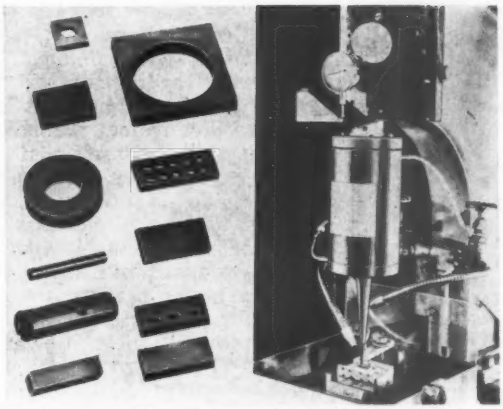
The reverse side of the calculator is a slide rule for determining the weights of metal pieces, using the length, width and thickness of the piece and the material factor from the table.

The Wittek Mfg. Co. is offering this CARload of sprocket-ratio data free of charge to all who request it. **Circle No. D2.**

Sheffield Will Produce Cavitron Machine Tools

The Sheffield Corp. of Dayton, Ohio has taken over the design, manufacture and marketing of Cavitron machine tools. In addition to Sheffield's exclusive distribution rights for the United States and Canada, the Dayton firm and the Cavitron Corp., of Long Island City, N. Y., will join in marketing the machines abroad. Cavitron will continue to produce the ultrasonic transducers and generators, being the originators of the ultrasonic machining process (see T & P, page 56, July, 1953) and holders of the basic patent rights.

The Cavitron machine tool is a device utilizing an ultrasonic vibrating head and an in-



"Magic" machining of "unmachinable" sintered carbides and borides, stellites, hardened tool and die steels, glass, ceramics, jewels and other hard materials (left) is achieved by ultrasonic 20,000 vibrations per second. View at right shows Cavitron machine tool set up to carve a narrow slot in a carbide blank.

expensive tool (such as soft steel) for the precision cutting of hard and brittle materials, either ferrous or non-ferrous, such as carbides, germanium, hardened tool steels, sintered aluminum oxide, etc.

. . . Gaging, from page 114

errors. Referring back to the discussion of the advantages and disadvantages of snap and ring gages, it will be seen that analysis of these troubles would not be so simple were these gages to be used.

Need for Wider Tolerances

In concluding, a few remarks concerning specified tolerances are not out of place. It has been demonstrated that gage tolerances eat very heavily into the working tolerance of a screw thread. For this reason, the manufacturer very often has only one-half the specified tolerance to work to and he finds it difficult. This difficulty is then reflected in higher costs.

A few years back, experiments were conducted with Class 2 and Class 3 threads and in the course of these experiments the screws were pulled apart on a tensile test machine. The difference in strength was negligible; in some cases the Class 2 were stronger than Class 3.

There is little to be gained by specifying Class 3 threads but a great deal can be saved in cost by specifying Class 2 or preferably the new Unified tolerance Class 2A, which has the all important feature of having an allowance between the maximum size screw and the minimum size nut.

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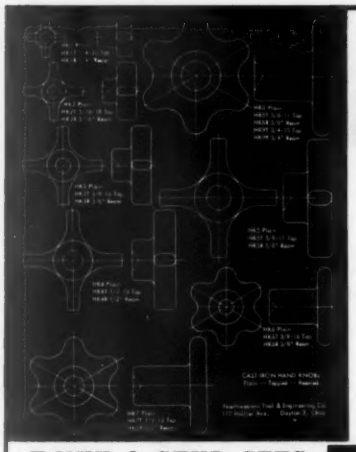

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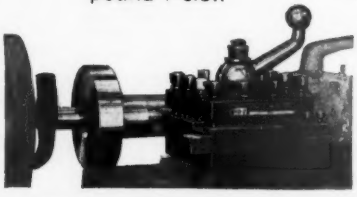
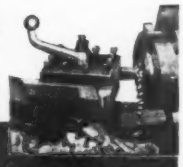


Same tool used for inside chamfering merely by indexing back two positions or 60°.



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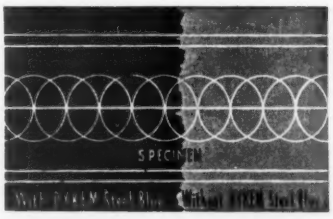

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CIRCLE INFORM-A-GRAM KEY NO. 120C

. . . Compleat Engineer, from page 81

greater comprehension. Harold L. Johnson, who conducts the course in reading ability improvement, has conducted surveys to determine the actual reading skills and problems of graduate engineers in industry. Further, he is utilizing these findings to develop methods and materials for the undergraduate reading program at Case so that we may better prepare our students for the actual situations which they will meet after graduation. These surveys show that the average graduate engineer spends 4½ hours a day reading about 250 words a minute. It is apparent from this that if his reading speed were doubled great benefits would accrue to the engineer himself as well as to the company.

Mr. Huebner mentions a logical question which might have occurred to his audience, "Why do engineers have trouble getting their ideas across to other people?" He then continued to answer the question by saying that it was important that one first analyze the situation from the viewpoint of other people. And, as he remarked, "it's the basic problem in dealing with people."

At Case, we are well aware of the fact that engineering entails more than slide rules, computers, transits and retorts and have endeavored to develop a well-rounded co-curricular program of activities to produce a Case engineer, a man among men. In participating on student publications, speech activities, musical clubs, and athletics, he learns the qualities of leadership and of cooperating with others. These activities contribute greatly toward producing the kind of man whom Mr. Huebner describes: "The search is for engineers who can lead men, direct men, persuade men and inspire the confidence of men."

The past record of engineering education has been remarkable. **Fortune** recently reported, for instance, that almost half of 900 top American executives had had engineering backgrounds. A survey of our Case graduates similarly shows that 22 per cent of them have become presidents or vice-presidents within thirty years after their graduation. But we cannot rest on our laurels;

changing times require changes in education such as those I have briefly described.

As I close my sixth year as president of Case and review the nearly seventy-five years of educational service performed by the Institute, I am impressed with one significant fact. It is that a technical education is becoming a good general education, a sound preparation for careers as managers and citzens as well as in technical fields. We want our graduates prepared to keep pace with the changing demands that tomorrow's society will undoubtedly place upon them. We believe that they must be ready to assume their responsibilities in management and their obligations in civic and community affairs. For that reason, I am proud that Case is one of the first engineering colleges to become concerned about the requirements that the engineer must face now and in the future. To cope with the fast moving and constantly changing stream of tomorrow, only the "Compleat Engineer" will suffice.

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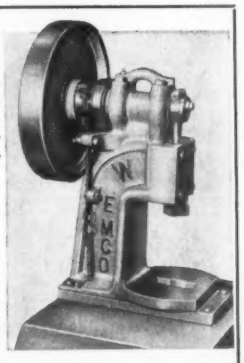

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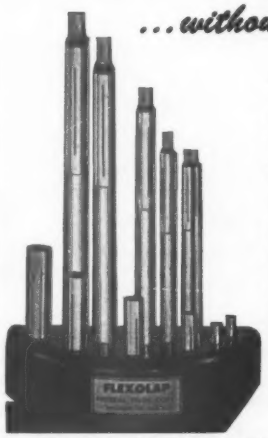

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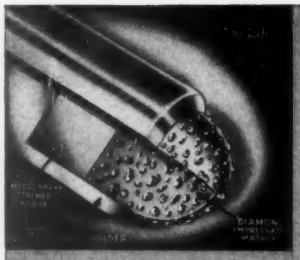

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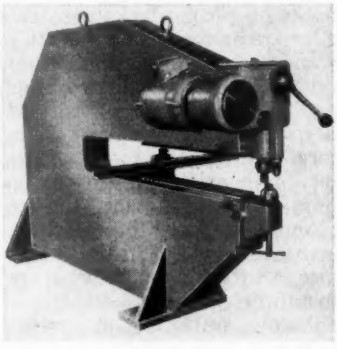
The Pullmax Model P-5 sheet and plate working machine, designed for general maintenance department work where sheet metal must be cut to many sizes and shapes, and formed by beading, folding, dishing or louvering, will be on display at the Plant Maintenance Show, January 25-28, International Amphitheatre, Chicago, Illinois.

The machine works mild steel up to 7/32" capacity, and has a throat depth of 42". Adjustable centers permit the cutting of various size circles, while an adjustable guide aids in making straight cuts or square holes.



Because of its movable upper tool, it will cut inside or outside work, and accomplishes this cut by a reciprocating action that leaves an edge that requires no further finishing.

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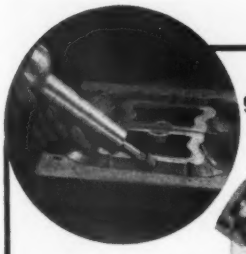

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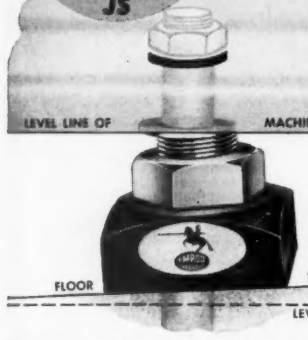

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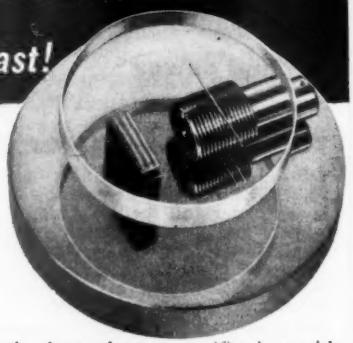

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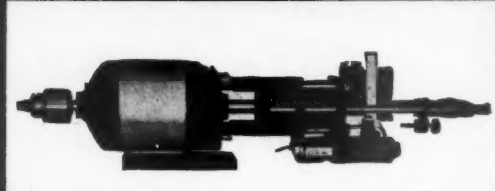

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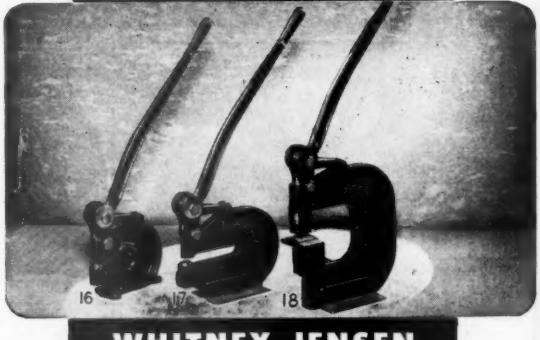

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Sampling Methods Affect Accuracy of Analyses

A two-day visit by a "trouble-shooter" from an industrial consulting firm solved a problem that had complicated quality control operations for several months.

The foundry was obtaining in its carbon analyses of steel castings results that were consistently higher than those obtained in its customer's laboratory. These discrepancies were often large enough so that the foundry could no longer be certain that the castings were meeting customer specifications. Careful and repeated checking of analytical procedures by the foundry's chemical staff failed to reveal any major sources of error. In the hope that an outsider's viewpoint would be helpful, a chemist from Sam Tour & Co., consulting and research firm, was called in to observe the entire analysis. The consultant followed the foundry's technicians through the analyses and confirmed that they had been accurately following recognized standard analytical procedures.

The investigation then led back one step, to a survey of how the samples for analysis were obtained.

The coupons (sample bars) were taken to the laboratory in the same condition as they were when removed from the mold. In this "as is" condition — with mold sand and an oxide coating adhering to their surfaces — the coupons were drilled to obtain chips for the analytical samples. Drillings were taken from one or several locations on the blank until a sufficient quantity of chips was obtained. Pressure was applied steadily during the entire drilling operation. The resulting chips were then screened, and those chips between 8 and 20 mesh were saved. The oversize chips and the fines, which included the sand and oxide coating, were discarded. These initial steps contained several major faults.

First, when the technicians discarded the undersize chips, they not only discarded the undesired sand and oxide coating, but also, quite probably, some segregated portions and hard particles that often end up in the fines. Consequently, the samples obtained by selective screening were probably not representative of the castings. Actually, what should have been done was to remove the adhering sand and the oxide coating by grinding. Then, with these extraneous materials removed, the coupon should be drilled and all the chips obtained used for the analytical sample. Oversized chips could be broken up in a mortar.

Second, the steady application of pressure of the drill into the blank caused the drill to overheat, resulting in partially-to-badly burned chips, identifiable by discolorations ranging from straw color to dark blue. Burned chips, although acceptable for other types of determinations, should not be used for carbon analysis, since their use almost invariably produces erratic results.

For proper drilling, the consultant recommended drill speed of 400 rpm maximum, but preferably 250 rpm. For stainless steel, he recommended the use of a straight, double-fluted drill or carbide-tipped flat drill, and emphasized that the drill must be sharp. Dull drills cause overheating, irregular chips, and excessive wearing of the drill which might contaminate the sample. Furthermore, the drill must not be fed continuously into the work, but should be raised and lowered repeatedly. This practice prevents overheating and thus burning of the chips, and will also produce a more uniform size of chip for the analysis. When a bar is drilled, it should be drilled on both faces, at scattered locations on the bar, and through about three-quarters of its thickness. This procedure assures representative samples.

Furthermore, the consultant pointed out that every effort should be made to prevent contamination of the sample with oil or other carbonaceous material. Such materials will introduce extraneous carbon into the analysis, should be free of oil, and the drillings must not be handled. Further precautions to assure the absence of oil should be taken by washing the drillings with ether prior to beginning the analysis.

Analytical errors can be reduced by pre-igniting the alundum bedding in the combustion boats before use to destroy any adhering carbonaceous material. Analytical glassware should be handled with lint-free cloths; never with the bare hand.

To give a better check on analytical techniques over a wide range of compositions, the consultant suggested that various types instead of only one type of Bureau of Standard samples of stainless steel and monel metal be analyzed daily. Previously the foundry technicians had checked their techniques using the same type of B. of S. sample each time.

Several newer and timesaving methods for routine analyses were also suggested. These include: methods for the simultaneous determination of manganese and chromium, the substitution of a colorimetric method for routine molybdenum analyses to replace a slower and more costly gravimetric method; and techniques for reducing the working time required to analyze nickel, phosphorous, and iron in monel metal.

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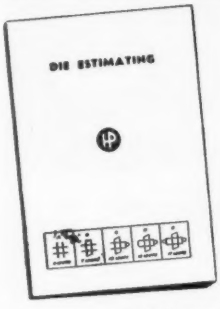

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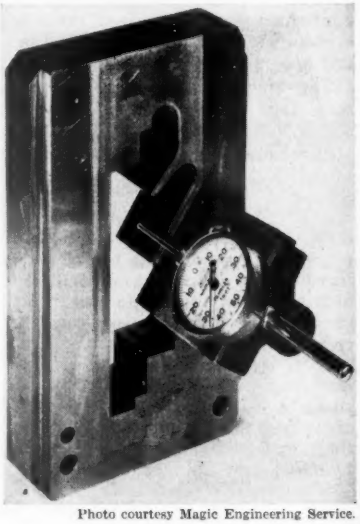

Photo courtesy Magic Engineering Service.

With the checker positioned adjacent to the die opening, as shown, the diemaker or inspector can slide the indicator assembly so that the ball end of the spindle travels over and bears against (by spring pressure) the surface of the die opening.

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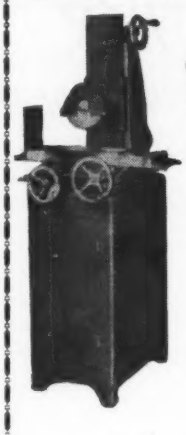

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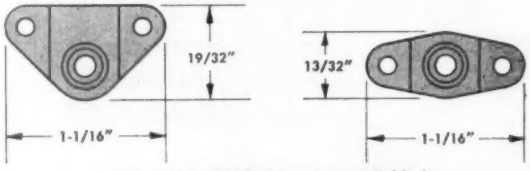
Used for drilling holes through round stock and hex stock from ¼" to 2" and cap screws from ¼" to 1¼", the new Mathewson Adjustable Drill Jig eliminates layout and can cut drilling time on small lots to a fraction. And it eliminates the costs of special jigs for larger quantities. Holes for cotter pins, set screws, drive pins for bayonet joints, oil holes in tubular sections, and wiring holes in cap screws, are all typical of the operation that can be done more economically with this jig. Hole diameters range from .052" to .531", using your A.S.A. standard slip bushings. The hardened V-block has two 60-degree V's for centering round or hexagonal stock, one for ¼" to 21/32" diameter, one for 21/32" to 2" diameter. Adjustable stop for locating work longitudinally for drilling any distance from end, may be used on either side. Adjustable bushing carriers hold slip bushings and clamp work securely. Jig highly successful in permitting use of inexperienced drill operators. For circular write to: **Mathewson Machine Works**, 38 Hancock St., Quincy, Mass.

CIRCLE INFORM-A-GRAM KEY NO. 127B

it's NEW! our EXTRA small ANCHOR BUSHING

for minimum hole patterns



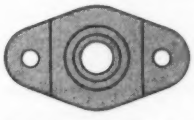
Extra small Anchor Bushings are available in drill sizes from #55 (.052) to 5/32 (.1562).

The extra small Anchor Bushing offers the template maker reduced minimum hole layout dimensions for drill templates.

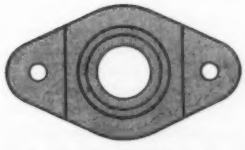
Bushing life is lengthened by improved heat treatment resulting from reduced wall thickness.

For sheet metal or laminate plastic templates, the bushing pilot length is optional – .050 standard, .125, .187, .250 or .312.

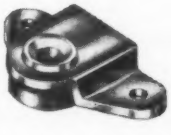
Write for data sheet for extra small Anchor Bushing physical dimensions, minimum layout patterns and catalog. The latter describes other available Anchor Bushings for metal and laminate templates.



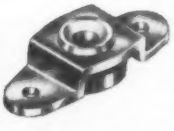
Small Anchor Bushings in drill sizes from #22 (.1570) to 9/32 (.2812).



Large Anchor Bushings in drill sizes from L (.2900) to 7/16 (.4375).



Extra Small Standard Anchor Bushing, Corner Style.



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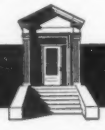

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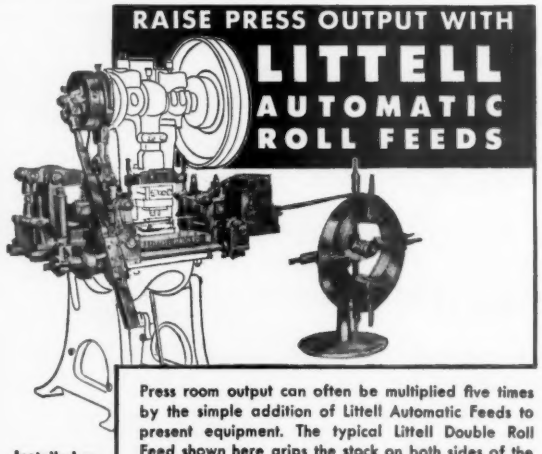

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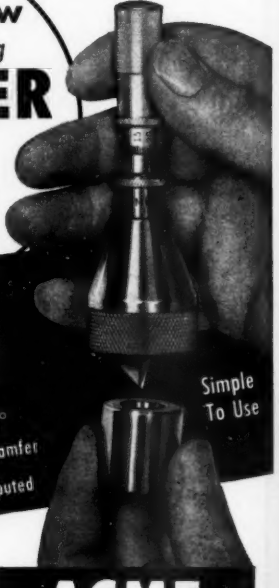

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Computer Applications to Feature Conference on Management Sciences

Tentative plans have been laid for a Conference on the Management Sciences, under the sponsorship of the School of Business Administration and the College of Engineering at the University of California, Los Angeles. This conference will be devoted to the problems of operating managers and their staffs relative to the application of recent developments in mathematics and electronics.

Major emphasis will be placed on computer techniques. Among the sessions tentatively listed are those on Mathematical Methods in Programming, Data System Design and Analysis, Logic of Computers, Programming Computers, and Statistical Methods in Management Measurement and Control. Both theory and case studies will be presented. It is intended, also, to have various types of commercially available equipment on display for study and discussion.

Two principal groups will be served by this conference: Group 1 to include works managers, controllers, production control managers, and others who must develop management programs, plans or schedules which are governed by some optimizing criterion; and Group 2 to include senior accountants, systems managers, engineers, and others who design or operate "business systems," but who do not have to construct optimizing programs.

This Conference has been tentatively scheduled for February 1 to 12, the last two days of which will be integrated with the AIEE-IRE-ACM Western Computer Conference. Further details will be available from Dr. M. E. Salveson, Industrial Logistics Research Project, University of California, Los Angeles 24, Cal. For a review of one area for computer application, see "Electronic Production Control . . .",by one of Dr. Salveson's associates (T & P, Sept. '53, p. 62).

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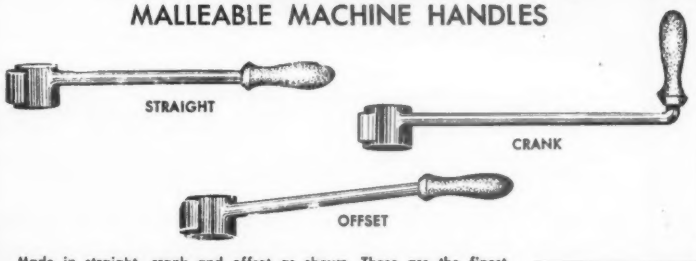

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5	23	60	81	97	110	117C	123D	129C	138B	143	148C	154A	158C	163D
6	24	63	82	98A	111	118A	124A	130	138C	144A	148D	154B	158D	165
7	25	65	83	98B	112A	118B	124B	133	138D	144B	149	154C	158E	166
8	26	66	84	98.1A	112B	119A	124C	134A	139A	144C	150A	155A	159A	
10	27	67	85	98.1B	112C	119B	124D	134B	139B	144D	150B	155B	159B	
12	28	68	86	98.2	112D	120A	125	134C	140A	144E	150C	156A	159C	
13	29	69	87	100	113A	120B	126	134D	140B	144F	150D	156B	159D	
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17	33	75	91	104	116A	121C	128A	136D	140F	145C	151B	157B	162A	
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6	24	63	82	98A	111	118A	124A	130	138C	144A	148D	154B	158D	165
7	25	65	83	98B	112A	118B	124B	133	138D	144B	149	154C	158E	166
8	26	66	84	98.1A	112B	119A	124C	134A	139A	144C	150A	155A	159A	
10	27	67	85	98.1B	112C	119B	124D	134B	139B	144D	150B	155B	159B	
12	28	68	86	98.2	112D	120A	125	134C	140A	144E	150C	156A	159C	
13	29	69	87	100	113A	120B	126	134D	140B	144F	150D	156B	159D	
14	30	71	88	101	113B	120C	127A	136A	140C	144G	150E	156C	160A	
15	31	72	89	102	115A	121A	127B	136B	140D	145A	150F	156D	160B	
16	32	74	90	103	115B	121B	127C	136C	140E	145B	151A	157A	161	
17	33	75	91	104	116A	121C	128A	136D	140F	145C	151B	157B	162A	
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A2	A14	A26	A38	B9	B21	B33	B45	B57	B69	B81	C7	E2	E14
A3	A15	A27	A39	B10	B22	B34	B46	B58	B70	B82	C8	E3	E15
A4	A16	A28	A40	B11	B23	B35	B47	B59	B71	B83	C9	E4	E16
A5	A17	A29	A41	B12	B24	B36	B48	B60	B72	B84	C10	E5	
A6	A18	A30	B1	B13	B25	B37	B49	B61	B73	B85	C11	E6	
A7	A19	A31	B2	B14	B26	B38	B50	B62	B74	B86	C12	E7	
A8	A20	A32	B3	B15	B27	B39	B51	B63	B75	C1	C13	E8	
A9	A21	A33	B4	B16	B28	B40	B52	B64	B76	C2	D1	E9	
A10	A22	A34	B5	B17	B29	B41	B53	B65	B77	C3	D2	E10	
A11	A23	A35	B6	B18	B30	B42	B54	B66	B78	C4	D3	E11	
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A3	A15	A27	A39	B10	B22	B34	B46	B58	B70	B82	C8	E3	E15
A4	A16	A28	A40	B11	B23	B35	B47	B59	B71	B83	C9	E4	E16
A5	A17	A29	A41	B12	B24	B36	B48	B60	B72	B84	C10	E5	
A6	A18	A30	B1	B13	B25	B37	B49	B61	B73	B85	C11	E6	
A7	A19	A31	B2	B14	B26	B38	B50	B62	B74	B86	C12	E7	
A8	A20	A32	B3	B15	B27	B39	B51	B63	B75	C1	C13	E8	
A9	A21	A33	B4	B16	B28	B40	B52	B64	B76	C2	D1	E9	
A10	A22	A34	B5	B17	B29	B41	B53	B65	B77	C3	D2	E10	
A11	A23	A35	B6	B18	B30	B42	B54	B66	B78	C4	D3	E11	
A12	A24	A36	B7	B19	B31	B43	B55	B67	B79	C5	D4	E12	

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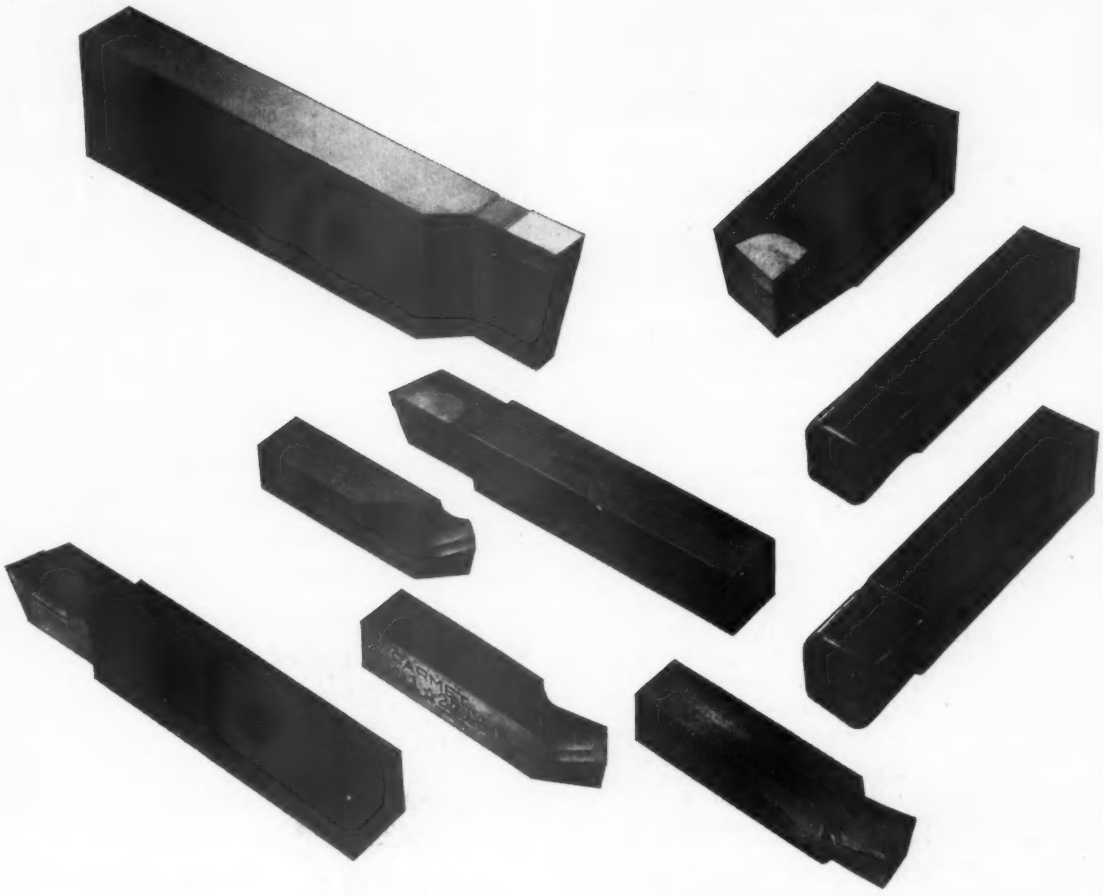

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4 TYPES—2 lengths of spindle extension; 2 types of air control valves, one for continual operation and one for intermittent work. Steel body for safety. No lubrication required. Abundance of power. Light-weight 12 ounces. Whole length 5-3/8", length of body 3". Accommodates mounted grinding wheels, rotary files, etc. on 1/8" dia. shanks. Speed such as to operate Tungsten Carbide burrs, rotary files, etc. to their full efficiency. "Remember, Built-in Quality Remains Long After First-Cost disappears."

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New 16 PAGE

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THE ☆ Star Dust ☆ LINE!

A COMPLETE RANGE OF LABORATORY GRADED DIAMOND ABRASIVES FOR EVERY PURPOSE

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Superior diamond quality combined with new bonding formula.

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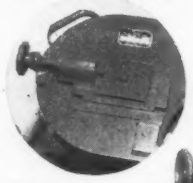
You can put your confidence in the STAR DUST line as so many others do because STAR DUST quality is consistent quality—the result of our special process of laboratory crushing and grading to achieve uniform nodular shape. That means *all* particles work for you. Be "Laps Ahead." For easier grinding and mirror finishes specify STAR DUST products.

For complete information and catalog write Dept. C-12

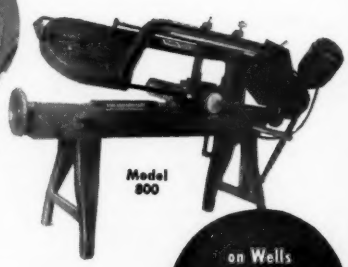
ACE ABRASIVE LABORATORIES
NEW ADDRESS: 35 ROSELLE STREET, MINEOLA, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 134C

NOW Wells offers you fool-proof blade tensioning . . .



Above is a close-up of the new Wells blade tensioning device.



Model 800

on Wells No. 5, No. 8, No. 12 and Model 800 cut-off saws

NOW IT IS POSSIBLE to maintain a constant blade tension on Wells cut-off saws. You can replace or change the blade any number of times, yet quickly and easily duplicate the correct blade tension. The new device is standard equipment on the models listed above. Simply turn the tension hand wheel until the fixed and moving indices coincide. At this point the blade tension is correct regardless of variation in blade length.

Wells

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METAL CUTTING BAND SAWS

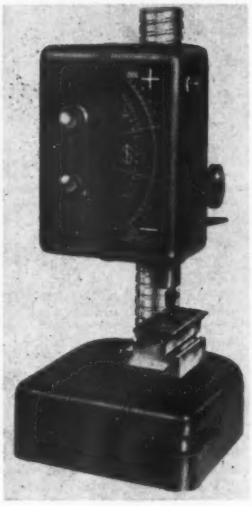
WELLS MANUFACTURING CORPORATION
1940 CEDAR ST., THREE RIVERS, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 134D

PROGRESS ON PARADE

NEW DEVELOPMENTS • IMPROVEMENTS • COST AND TIME SAVERS — Mail FREE Inform-A-Gram Card for MORE Details

Vertical Mechanical Comparator. Cosa Corp., 405 Lexington Ave., New York 17, N. Y., is now marketing a vertical, mechanical comparator manufactured by the Sigma Instrument Co., Letchworth, England. This instrument is used for checking dimensions of parts at



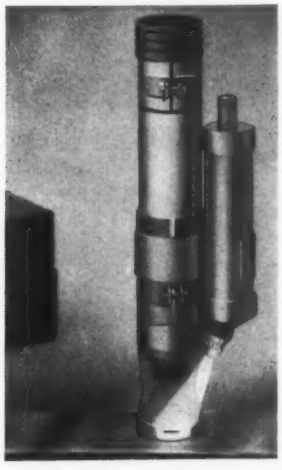
the production line, in the tool room and the inspection department. Because it is completely mechanical, it sets up anywhere in a plant without making or breaking electrical connections. It has magnifications of x500, 1000x, x1,500, x3,000 and capacities of 6" and 12" in each magnification. Write to Cosa for further information. **Circle No. A1.**

CARBIDE BELT FINISHER

This unique and efficient method for the final finishing of carbide tools incorporates the use of an abrasive belt and a specialized machine, the Model 454 carbide belt finisher. The machine will finish the top of a tool as well as

the usual 1/16" land below each cutting edge. The finishing is done against a carbide faced platen, which permits uniform grinding pressure and surface flatness. The finisher also can be advantageously used for finishing high speed steel tools. Further information is available from Hammond Machinery Builders, Inc., 1631 Douglas Ave., Kalamazoo, Mich. **Inform-A-Gram No. A2.**

Microscope Reader. A new low-cost Brinnell microscope-reader, for the measurement of the diameters of indentations made by the ball indenters of all Brinell type hardness testing machines, has been announced by the Pacific Transducer Corp., 11921 W. Pico Blvd., Los Angeles,

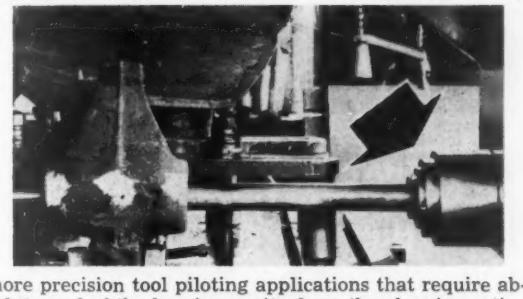


Calif. It has a magnification of 20 diameters with clearly and easily visible indentation. The instrument also can be used wherever a microscope is needed to make flat measurements within a range of 7.0 mm., and for all other shop and laboratory uses where medium magnification is required. **No. A3.**

Automatic Stop. Here is a stop designed to eliminate the necessity of handmade stops and to standardize on a stock device capable of satisfying every application. The stop, which comes in two sizes, will work on any kind of

die and can accommodate all jobs up to the very large dies. This Universal automatic stop can be installed in a very few minutes. Further data on this extremely versatile device can be had from the R. Krasberg & Sons Mfg. Co., 2501 W. Homer St., Chicago 47, Ill. **No. A4.**

Live Pilot Bearing Bushings. The J. G. Jergens Co., 11106 Avon Ave., Cleveland, Ohio, has announced a complete new range of over 50 standard sizes for its live pilot bearing bushings. The new sizes make practical many



more precision tool piloting applications that require absolute seal of the bearing cavity from the abrasive action of grit and coolants. A catalog specifying complete dimensions for all sizes is available from the manufacturer. **Circle Inform-A-Gram No. A5.**

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PRODUCTO-CHEK
Mechanical Comparator

- Low Cost
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- Speeds Inspection
- Direct Reading
- Reduces Error
- No gears, lever, racks.

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.0001", .00005" and .000010" gaging heads.

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Air Cylinders with built-in operating valves are now being produced by Carter Controls, 2920 Bernice Rd., Lansing, Ill. These cylinders eliminate pipe connections usually required for double acting cylinders and greatly increases the efficiency of the cylinders by reducing line friction. Further information will be furnished on request.

Circle Inform-A-Gram No. A6.

Cutter Grinder. This is the improved Mico Cutter Grinder and it features such items as a separate grinding wheel spindle assembly that permits the use of pre-loaded ball bearings which are shielded and greased for long life. For further information write for catalog to Mico Instrument Co., 88 E. Trowbridge St., Cambridge, Mass.

Circle Inform-A-Gram No. A7.

Spade—Drill Holders. Especially designed for use on large automatic screw and chucking machines is a new line of spade drill holders with short overall length and straight shank. They are made in sizes ranging from 1¼" to 3½" in cutting diameter. They are drilled for coolant and have two threaded coupling holes, allowing a choice of coolant coupling connections. These new short-length holders are machined to use standard Waukesha spade drill blades as are now used for deep hole drilling operations. They also are readily adapted to the use of special blades that combine drilling with facing, chamfering or counterboring. Engineering specifications and other data are available from the Waukesha Tool Co., Waukesha, Wis.

Circle Inform-A-Gram No. A8.

HAND CONTROLLED
Di-Profiler
TRADEMARK

Makes the toolmakers work easier—takes the "Hard Labor" out of hand work.

The Di-Profiler is a new multiple action tool that (1) Reciprocates (2) Oscillates and (3) Rotates when used with the spindle attachment. Stroke is adjustable from 0" to ¼".

It files, hones, polishes, laps, chafes and saws materials ranging from carbide tools to soft materials. The only machine of its kind. Write for full details and price list today.

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The drill spindles are held rigidly in position when two nuts are tightened. Sturdily constructed. Suitable for adaptation to large or small drill presses. Models A and B made with sleeve. Models C and D with overarm adaptation, equipped with guide pins, springs and brackets, mounted to a cast-iron base with surfaces ground for use of drill fixtures. All models can be used for drilling or tapping on tapping machine or drill press with reversible spindle. Also used with standard tapping heads.

Multiple heads with fixed center distances are designed and built to meet your requirements. Available with GM Sleeves, Morse taper or drill chucks.

Write for full information

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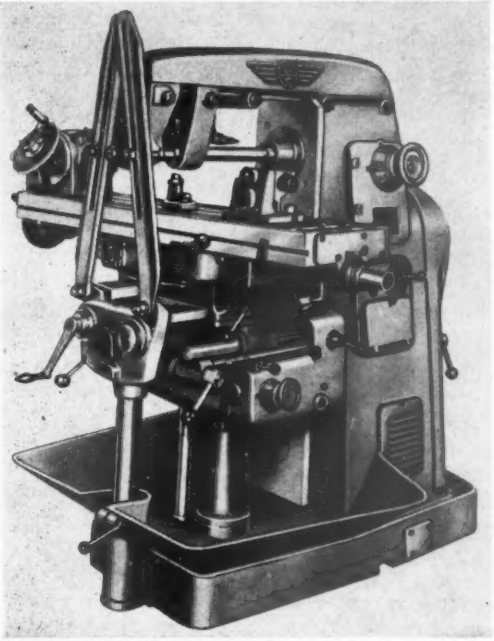
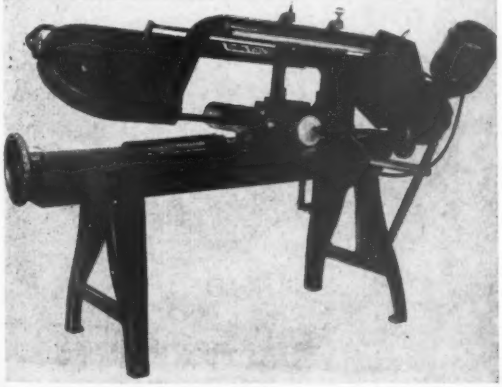
Carbide Plug Gages. A new line of tungsten carbide reversible plug gages is now available in a size range from 0.025 to 0.760 diameter. Further information on these new gages can be had from S & E Machine Products, Inc., Bridgeport, Mich. **Inform-A-Gram No. A9.**

Precision Milling Machine. This is the Hercules No. 2 Precision milling machine made in Denmark to American standards and well suited for tool room work and production. The machine is equipped for power rapid



traverse in all 3 directions and the table feed and rapid traverse are all controlled by a single lever. Electrodynamic braking provides quick stopping action. Write to the American distributor of this machine, the Parker Machine Co., 158 Pioneer St., Brooklyn, N. Y., for additional data. **Circle Inform-A-Gram No. A10.**

HSS Band Saw Blade. "Milford Rezistor" high speed steel blades are now being used in the new horizontal metal cutting band saws being made by the Wells Mfg. Corp. Other advantages of the firm's latest saw include heavy duty counter-balance frame and beam, new



style band wheels providing for use of 1" wide blades; new constant-load blade tensioning device; and synchronized speed blade cleaning brush. For further information write to Wells at 1940 Cedar St., Three Rivers, Mich. **Circle Inform-A-Gram No. A11.**

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WITH
New 4 Speed
VARILIFT

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Model	Standard Shop Caddy Lifting Height	Platform Size	Capacity
4036	36 in.	20" W. x 16" L.	500 lbs.
4054	54 in.	22" W. x 19" L.	500 lbs.

Platform descends to floor level for easy loading. 8 inch Molded Rubber Wheels and Varilift 4-speed system are standard equipment.

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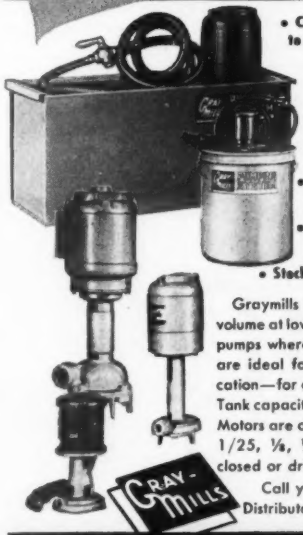

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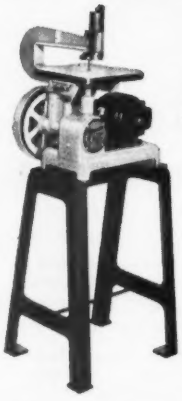

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. . . for high speed Precision Grinding of curved and Irregular Contours

Standard features include 20,000 or 30,000 R.P.M., or a combination of these spindle speeds, ½ H.P. motor, Collet Chuck, Compound tilting table, built-in wheel dresser.

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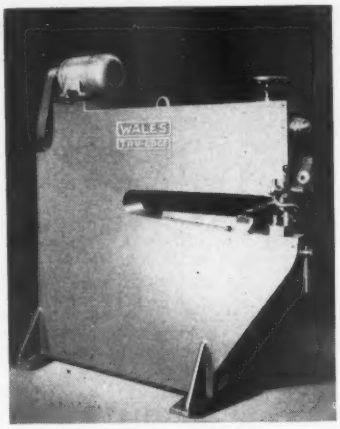
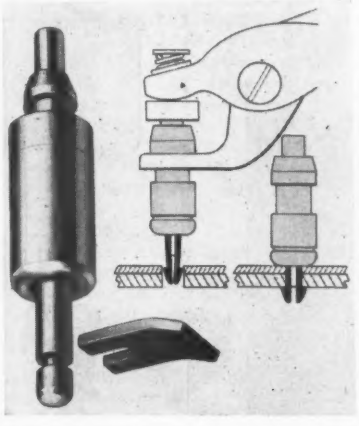


work. In addition, feeding of material may be started while ram is operating and no starting holes are required for inside cutting. For more information on this shear write to Wales-Strippit Corp., 345 Payne Avenue, North Tonawanda, N. Y., for fully illustrated, colored catalog. **Circle Inform-A-Gram No. A12.**

Sheet Metal Fasteners. Metal or hard surface parts containing drilled or punched holes now can be temporarily held together in alignment and under pressure when combined materials are as much as 4 inches thick. These metal fasteners in a variety of sizes offer time and labor-



saving advantages. Complete literature on the locking principle and job applications from the Wedgelock Co., 5446 Satsuma Ave., North Hollywood, Calif.
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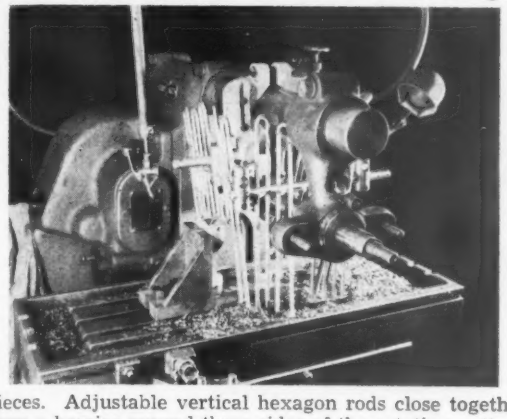
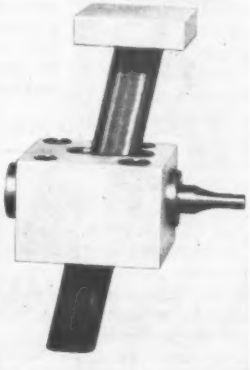
Milling Machine Guard. This guard is designed to prevent accidental injury on mills due to operator fatigue, caught sleeves, gloves, rings, etc. Also, increased production can be expected, because it is not necessary to stop the cutters or turn off the mill while changing

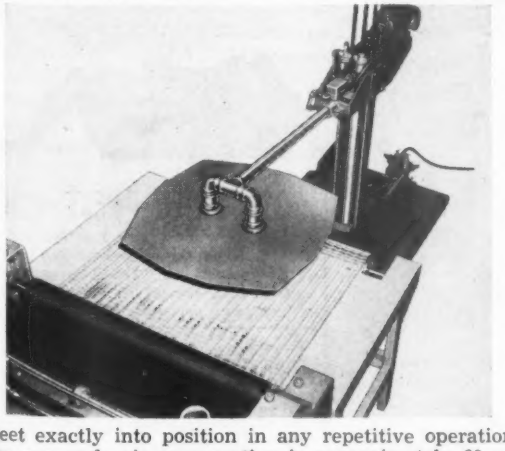


pieces. Adjustable vertical hexagon rods close together form a barrier around three sides of the rotating cutters. They are adjustable for various table settings. For further information write to Searjeant Metal Products, Inc., 71 Pittsford Rd., Mendon, N. Y. **Circle No. A14.**

For Building Cam Dies here is a time saver. The Octocam is especially designed to be used on all cam action dies. At the same time it simplifies the actual tooling operation. The barrel has approximately 3/16" travel per inch of press stroke. Parts are hardened and ground to insure precision and rigid construction for long performance. Further information available from the Octavia Tool & Gage Co., 3320 N. Kedzie Ave., Chicago 18, Ill. **Inform-A-Gram No. A15.**



Automatic Vacuum Lift. This new Union automatic vacuum lift will handle any nonporous metal up to 40" x 40" at from 1 to 6 sheets per minute. It will pick up at any level from the ground to 36" height. It also is adjustable through 180° turn so as to be able to lay the



sheet exactly into position in any repetitive operation. The per cycle air consumption is approximately 60 cu. feet. The machine weighs 1,800 lbs., requires a floor area of 36" x 48" for base with arm extending out about 4' and is 6' high. Write to the Union Tool Corp., Warsaw, Ind., for further information. **Circle No. A16.**

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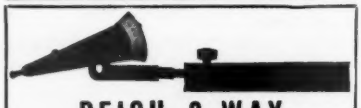

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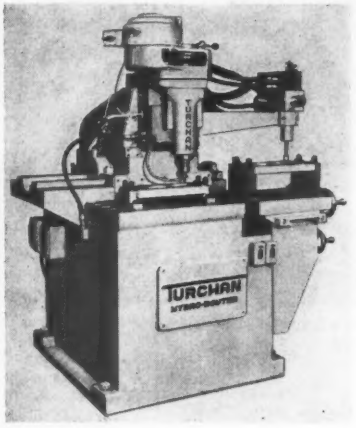
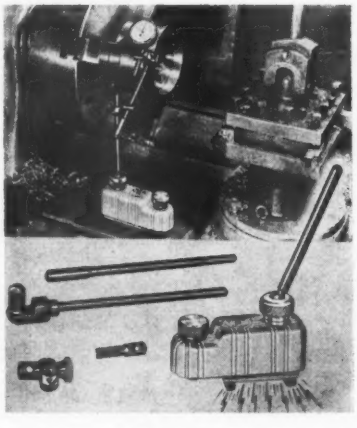


Ave., Detroit 4, Mich. Finger-tip operation is accomplished through hydraulic tracer servo-control and effortless and accurate positioning of vertical spindle slide, ram and ram slide is provided. The manufacturer will gladly supply additional information.

Circle Inform-A-Gram No. A17.

Base Holder. Designated as "Tiny-Titan" No. 150, a new powerful, heavy duty duplex magnetic base holder which instantly mounts test indicators up to 3" diameter to flat or down to ¾" round with a pull of 125 lbs., is now on the market. It



is engineered to give the utmost in utility at low cost and introduces a number of innovations which gives it a high degree of accuracy, precision and versatility. Further information is available from the Enco Mfg. Co., 4520 W. Fullerton Ave., Chicago 39, Ill. You can write direct to the company or—

Circle Inform-A-Gram No. A18.

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Vari-Tool Finisher. This machine offers an advantage to small and medium shops grinding high-speed steel or carbide tools. The solid carbide platen permits micro finish of end, top and side clearance angles on single point tools. The ¾ hp 3600 RPM motor is operated by a forward-off-reverse switch. For full information on this new Vari-Tool, write the Standard Electrical Tool Co., Mt. Hope & Sixth Sts., Cincinnati 4, Ohio.

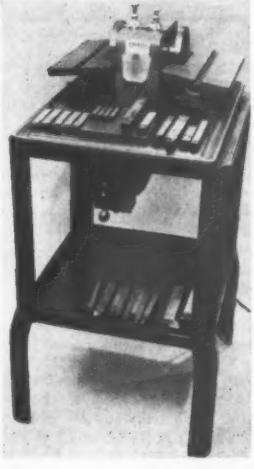
Inform-A-Gram No. A20.

Electropunch. A completely redesigned Electropunch, which incorporates important improvements in adjustment, operation and maintenance, has been developed by Black & Webster, Inc., Dept. 90, 445 Watertown St., Newton 58, Mass. A bench model that weighs only 50 lbs., this electropunch also features increased operating life. Design changes have been made in the base to give more working surface and a skirt added to protect the recessed hand switch from breakage or accidental operation. Further information will happily be furnished by Black & Webster.

Inform-A-Gram No. A21.

Carbide Tool Lapping Machine. A new type single point carbide tool lapping machine known as "Superior Tru-Finisher" has been developed by the Superior Cutter Co., 8010 Avalon Blvd., Los Angeles, Calif. Designed primarily for super finishing carbide tools, tests indicate it is possible to produce 3 or better micro-inch finishes quickly and efficiently. The use of this tool, has resulted in substantial savings in tool costs. Cutting speeds and feeds can be increased with closer tolerances being maintained for longer periods.

Inform-A-Gram No. A22.



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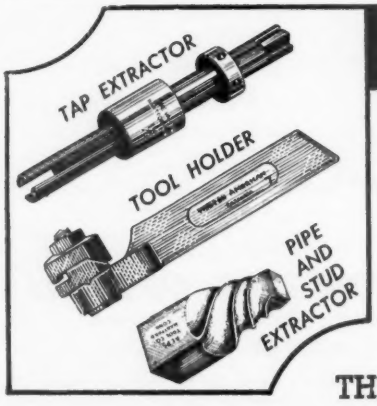

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SAVE LABOR
KEEP PRODUCTION MOVING

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CIRCLE INFORM-A-GRAM KEY NO. 142D

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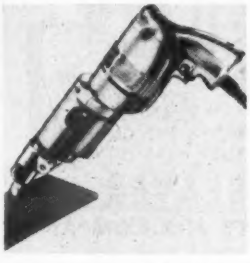
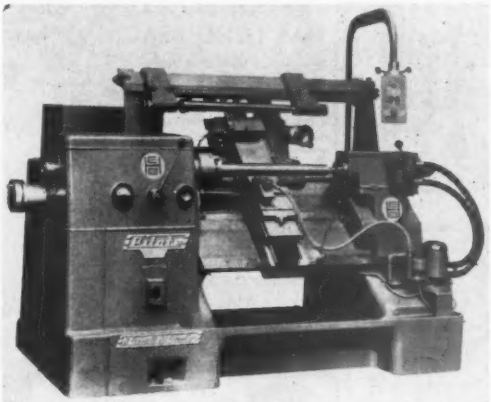
form with vee grooves; the dimension from the bottom of the fir tree form to the first convolution, the distance from the bottom of the second convolution to the top of the root form, and the lean of the blade to the vees. The Sheffield Corp., will gladly supply additional information to those requesting it. **Circle Inform-A-Gram No. A23.**



Drill Attachment. For ¼" portable electric drills, this E-Z cut drill attachment converts the drill into a power sabre saw which can be used for heavy duty work on all kinds of metal, wood, plastic and composition board. Write to Jaco Devices, 96 High St., Hingham, Mass., for further information. **Circle No. A24.**

Push-Button Metal Turning. Reported to be the first completely automatic hydraulic copying lathe equipped with a hydraulic carriage feed, the Pilote has just been introduced in the United States and Canada by H. E. B.



Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y. The Pilote has all the advantages of any single spindle automatic lathe, but the set-up on this machine can be changed in less than an hour. Completely descriptive literature is available upon request. **Circle No. A25.**

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DUST COLLECTING UNITS

They are used on surface and other grinders where grinding dust must be removed.

Inexpensive, compact units, with no moving parts. Operated from your present air supply.

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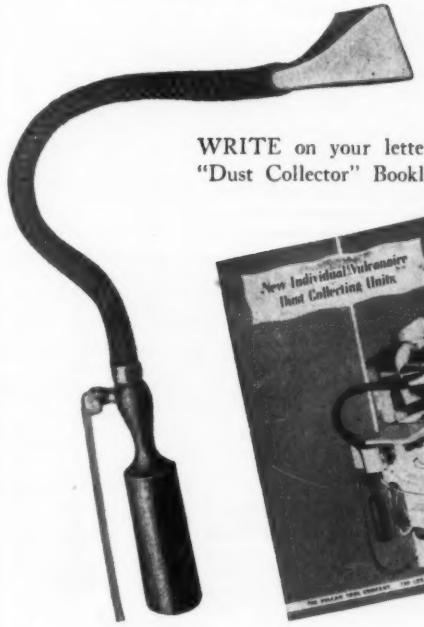

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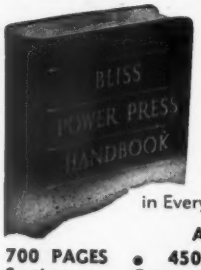

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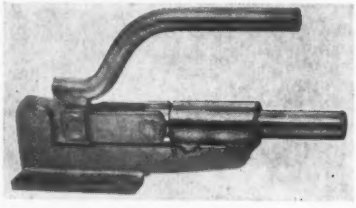
Circle Inform-A-Gram No. A26.

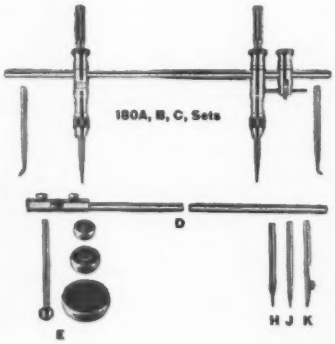
Toggle Clamp. The two outstanding features of the Caddy P-2 Plunger type toggle clamp are the 3,000 lbs. horizontal clamping pressure and a 2" stroke of the plunger.



Other advantages are extra large pivot pins, all welded construction and a heavy steel frame. For the complete story write to Erico Products, Inc., 2070 E. 61st Place, Cleveland 3, Ohio, or—

Circle Inform-A-Gram No. A27.

Steel Beam Trammels. Designed for easier use and greater accuracy in layout work, scribing and measuring is this free-turning steel beam trammel that has knurled grips on top of each tram for more convenient



operation. Trammel beams are 10½, 14½ and 20 inches long. Also, with 20" extension beam, circles up to 72" in diameter can be scribed with the trammel. Descriptive literature and complete price information is available from the Lufkin Rule Co., Saginaw, Mich.

Circle Inform-A-Gram No. A28.

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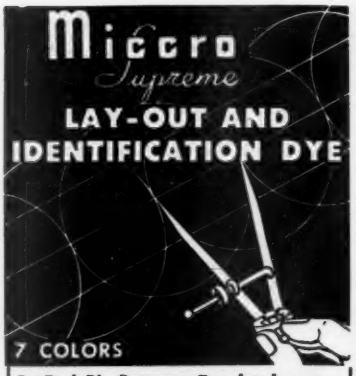

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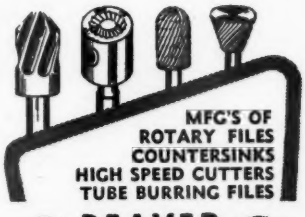

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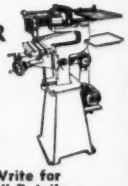

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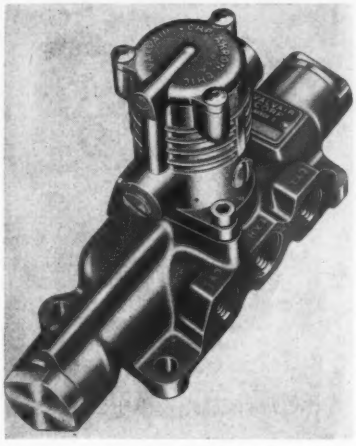

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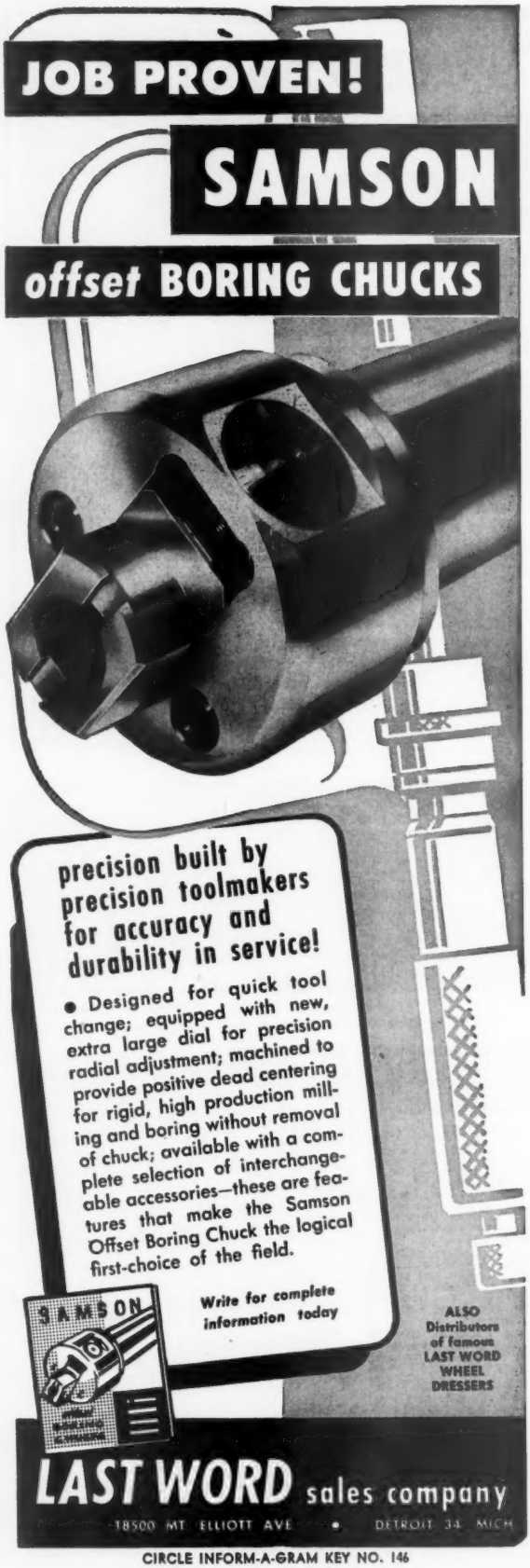
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• Designed for quick tool change; equipped with new, extra large dial for precision radial adjustment; machined to provide positive dead centering for rigid, high production milling and boring without removal of chuck; available with a complete selection of interchangeable accessories—these are features that make the Samson Offset Boring Chuck the logical first-choice of the field.
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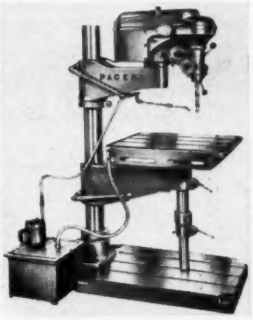
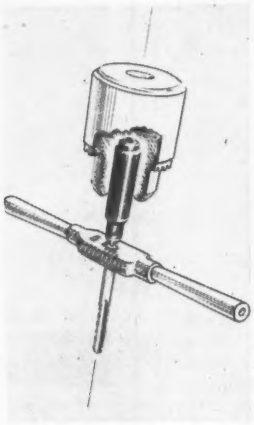
ALSO Distributors of famous LAST WORD WHEEL DRESSERS
LAST WORD sales company
18500 MT. ELLIOTT AVE. • DETROIT 34, MICH.
CIRCLE INFORM-A-GRAM KEY NO. 146

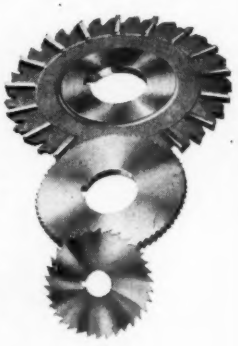
Head Drilling Machine. This Pacera articulated head drilling machine is for drilling small holes in large work. To ensure adequate rigidity for heavy work, the revolving work table is supported by a telescopic jack, but the work can also be carried on the base. Complete information may be obtained from the United Machinery Sales Co., 2351 N. St. Louis Ave., Chicago 47, Ill. **Circle No. A31.**

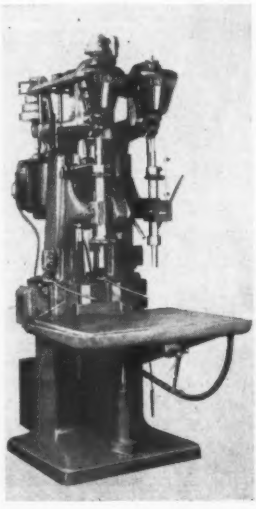




"Tap-Go" Spring Center. The "Tap-Go" Spring Center enables the operator to tap holes in precise location at the same time the work is being drilled. It is designed to telescope ⅜" while being used in a standard ½" chuck. The alignment is maintained all along the ⅜" travel of the center in the housing. It has hardened working parts throughout to minimize wear and maintain precision alignment. Further information on this spring center can be had from the Medelton Co., 335 E. 142nd St., Bronx 54, N Y. **Circle No. A32.**

Metal Cutting Tools. Summit metal slitting saws, screw slotting saws, small circular saws, side chip and staggered tooth saws have been made in Sheffield, England for over a century. Made of high tungsten steel, they are now available to American manufacturers through L. H. Chappel & Co., 1137 Post Rd., Fairfield, Conn. The exclusive distributors will be glad to furnish additional information to those desiring it. **No. A33.**

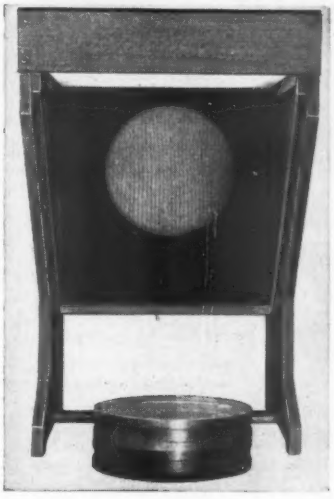




Drilling Machines. New developments that can lead to greater production at lower cost have been included in the new models of the vertical motor-cone-pulley drive drilling and tapping machines. Choice of single and multiple spindles, plus a wide range of spindle speeds and attachments broaden the work versatility and production possibilities of these modern tool room machines. Illustrated bulletins containing complete specifications, construction features, ordering information and other pertinent data can be had by writing to the Edlund Machinery Co., Cortland 38, N. Y.

Inform-A-Gram No. A34.

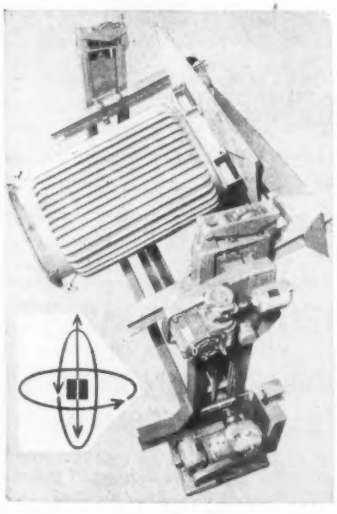
New Monochromatic Lamp. Acme Scientific Co., 1450 W. Randolph St., Chicago 7, Ill., has developed a new large-field monochromatic lamp, known as Model 700-L, especially de-



signed for use in laboratory or shop where absolute interpretations of interference fringes are required. It is available in sizes to cover optical flats with diameters of 10", 12", 14", 16", and 20". Full details sent upon request.

Circle Inform-A-Gram No. A35.

This New Positioner offers three degrees of freedom in positioning weld-jobs. Its maneuverability is practically unlimited and it will lift a job and turn it 360° vertically or horizontally. Standard models are



available in 8 different capacities for positioning jobs ranging in sizes from 500 to 20,000 lbs. All positioning is done automatically by pressing a button. The load is swung about a neutral axis. Additional information can be obtained from the Pandjiris Weldment Co., 5153 Northrup Ave., St. Louis, Mo.

Circle Inform-A-Gram No. A36.

For SPECIAL BROACHES QUICK, at LOW COST — du MONT

Broaches like these, and many other pull-type, push-type and keyseating machine broaches fit our regular production tooling on the famous *Minute Man* Keyway Broaches

That's why we can make 'em for you quicker and cheaper. *So send us your specs. or prints.*

Note: We cannot make broaches longer than 36" or with cutting sections exceeding 20"; nor round, spline, rifling or irregular shaped broaches, nor square broaches less than ¼" across flats.

The du MONT CORPORATION, Greenfield, Mass.

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You dress better for less with tangi-matic

Reid Bros. Surface Grinder dressing with a Perfex TANGI-MATIC

RECOMMENDED BY LEADING MANUFACTURERS OF SURFACE GRINDING EQUIPMENT

Now you can dress angles tangent to radii within "tenths" and set-up in one-fourth the time with the new TANGI-MATIC Dresser. A *built-in*, direct-reading micrometer eliminates "mikes", height gages, Jo Blocks and errors—and saves you time. Even novice operators obtain extreme accuracy.

TANGI-MATIC dresses any concave radius down to .032", full 180°. Set-up can be made without removing dresser from your grinder chuck. A removable dressing arm permits the use of extensions for large wheel dressing.

Wearing surfaces are hardened, ground and lapped for assurance of years of extra service over ordinary dressers. Lead screw is hardened and ground to extreme tolerances.

TANGI-MATIC is furnished complete with master setting block, small radius attachment, plastic hood and carrying case.

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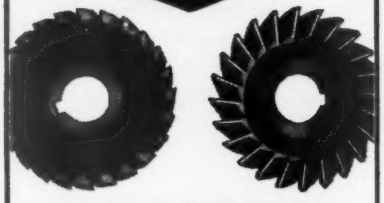
SHOPS SAVE
MONEY



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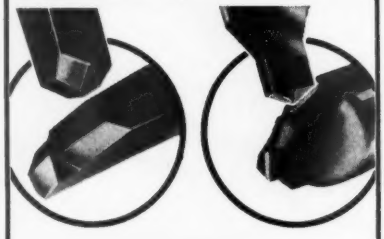
CUTTERS RECLAIMED

YOUR CUTTING TOOL COSTS can be cut by converting worn and obsolete high speed and carbide cutters for other jobs. Let us help you set up a tool salvage program.



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These designs have been proved in our shop. Drill holes and centers in steel hard as 66-C fast, accurately and without annealing.

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That's why they're fast, accurate, so adaptable, so easy to operate. Why maintenance is simple. Why initial cost is low . . . Often considerable savings and improved punch press operations are possible if you let our engineering staff assist you. There is no obligation. Simply furnish the details relating to your need or problem and if possible send samples or drawings of the work. You will hear from us promptly.

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RIMAT DIAL BORE GAGES

FOR PRECISION MEASUREMENT OF:

"O" RING GROOVES
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SIZES .300" to 6.000"

THE ORIGINAL INDICATOR GAGE DESIGNED FOR MEASUREMENT OF INTERNAL GROOVE DIAMETERS

For Information Write To
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BUSHING BONDING CEMENT

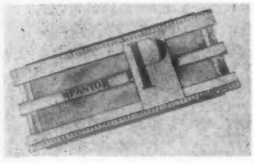
For Retaining Drill Jig Bushings
Use B-K 7 # CEMENT

No distortion of the jig plate or misalignment of the hole pattern. Eliminates lapping of press fit bushings after assembly. Not affected by drilling heat. Bushings can be retained in steel, aluminum or fiberglas jigs. Easily applied by untrained personnel. Especially recommended for use in "master tooling" operations.

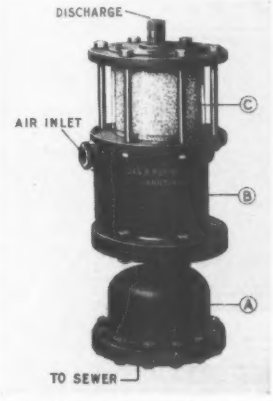
SHERIDAN PRODUCTS
1054 E. Hyde Park Blvd., Inglewood 3, Calif.

CIRCLE INFORM-A-GRAM KEY NO. 148D

A New Adjustable Copyholder for use on engraving machines has been developed by the H. Preis Engraving Machine Co., 282 Industrial Branch, Hillside, N. J. Called the Pries Pantograph Copy Holder, this tool makes possible a variety of copy combinations at one setting, thereby reducing the time involved in changing settings for complicated engraving combinations. The units may be used on any type or size of engraving machine and the sturdy construction will enable the holder to meet the most exacting requirements. Further information can be had by writing direct to the company, or— **Circle No. A37.**

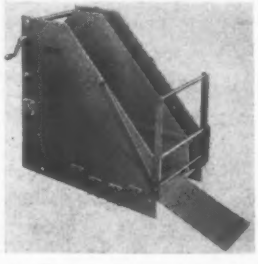


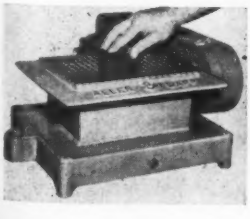
The New Murphy AA Separator-Filter is reported to be a thirsty little unit that will drink up any moisture and oil as well as all vapors present in compressed air lines. It also is said to be able to remove vapors present in compressed air by the use of a desiccant. The AA Separator-Filter is a product of the James A. Murphy & Co., Hamilton, Ohio. **Inform-A-Gram No. A38.**



A New Press Brake of unusually strong construction and high precision has been announced by the Service Machine Co., Inc., 506 Miller St., Elizabeth, N. J. Some of the dimensions of this 8' brakes are overall height, 79"; overall depth, 44"; depth at base, 36"; width at base, 64"; distance from floor to bottom of throat, 30½"; stroke, 3"; ram adjustment 4½"; strokes per minute range from 16 to 40; motor, 1½ hp; rpm, 1800; and bending capacity, 96", 16 gauge. Further information available upon request. **Circle Inform-A-Gram No. A39.**

Feeding Coiled Stock. The Koil-Kradle, a new device for automatically feeding all types of coiled stock to production machines, has been introduced by Benchmaster Mfg. Co., 1835 W. Rosecrans Ave., Gardena, Calif. This machine features an automatic trip bar which actuates a motor switch as the slack loop is tightened. The motor then feeds a new loop at the rate of 90' per minute (continuous operation), automatically shutting off when the correct loop size is reached. Literature is available from the manufacturer. **Circle No. A40.**

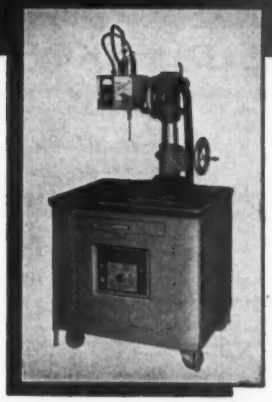




A Bench Type Lapping Machine utilizing the figure 8 lapping motion is now being produced by the Rhinevault Machine Company of Chicago. The 150 lb. machine can be mounted on any sturdy bench. Lopon Inc., 1649 Sherwin Ave., Chicago, Ill. **Circle No. A41.**

METAL DISINTEGRATION

and what it can do for you



Literally hundreds of thousands of dollars are saved annually by corporations that are using Metalmasters in just tool and die repair alone.

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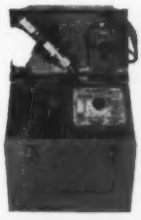

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Improved Screw Thread Production

The O-Vee Gauge, with the use of a standard hand micrometer will measure accurately the pitch diameter of a screw and indicate whether it is within standard limits. No calculations, tables or reference books required. Approved and used by leading Government Departments. Write for illustrated leaflets.

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DUSTKOP

Available from stock of 22 standard models.

300 cfm to 10,000 cfm

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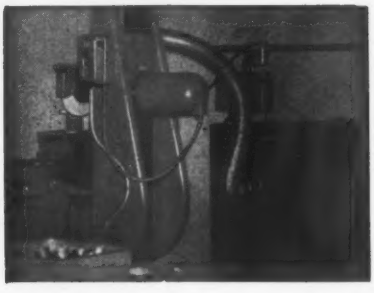
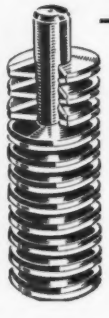


CIRCLE INFORM-A-GRAM KEY NO. 150B



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BECAUSE

1. Unlimited life within borders of permissible loads.
2. No creeping, initial settling or gradual fatigue.
3. Axial center pressure.
4. Exact adjustment to the desired pressure.
5. Small constructional height, large deflection.
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7. Large impact damping especially with multiple stacking.
8. Excellent space disposition.
9. Spring pressure, Spring length and Spring deflection can be easily determined for the same Spring size or can be changed by lengthening or shortening of the Spring columns or by multiple stacking. In special cases the character line can be made to divert from its usual straight form by diversified stacking.
10. Most spring sizes available from stock.

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HOW IMPORTANT IS CHATTERLESS COUNTERSINKING *To You?*

The Severance Chatterless Countersink is Engineered For Today's Fast Production Schedules. It Will Give You What You've Always Wanted In A Countersink. CHATTERLESS ACTION — SMOOTH SEATS — FAST CUTTING — LONG SERVICE.
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EC	3/8	1/4	1.85
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LI	1	1/2	7.00
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*PLUS 10% IN LESS THAN 10 OF ANY ITEM

SAVE YOUR TIME! Order directly from this Ad, give: Tool No. and Centerline angle desired. Thus: 12 only CB-30° 24 only GD-41°, etc.

ASK FOR A SEVERANCE CATALOG TODAY!

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CIRCLE INFORM-A-GRAM KEY NO. 150D

Waco Builds New Cleveland Plant

Completion of a new 18,000 square foot, one story branch office and factory on West 130th Street in Cleveland, Ohio, has been announced by the Waco Manufacturing Company, national manufacturers of steel scaffolding and shoring equipment, with headquarters in Minneapolis, Minnesota.

H. P. Albrecht, President, stated that the plant, which is constructed on a 3½ acre site, will house branch offices, welding bays, paint shop, assembly sections, warehouse and shipping facilities for both rail and truck. The building is of masonry and steel frame construction and is faced with brick.

Construction of the plant began in September, 1953 and was the third new structure built by Waco in the past six years to serve the construction and industrial market. The new plant will provide the company necessary facilities to serve customers in the eastern half of the United States.

ADJUSTABLE ROD GUARD for Power Presses

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HARDNESS TESTING

has been done with the SCLEROSCOPE since 1907

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THE SHORE INSTRUMENT & MFG. CO., INC

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Jamaica 35, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 150F

Bliss Acquires Die Supply

E. W. Bliss Company, Canton, Ohio, announces the acquisition of the Die Supply Company, 1400 Brookpark Road, Cleveland, manufacturers and distributors of die makers supplies for the metal-working industry. Newly elected officers of the company include H. U. Herrick, president; J. H. Tredinnick, executive vice president; W. H. Garrison, treasurer and F. J. de Lorme, secretary. These four officers hold corresponding positions in the

Bliss organization. Former Die Supply Company officials who will continue with the organization include John R. Fitzsimmons, founder, who will continue as Chairman of the Board; Warren Fitzsimmons, formerly president, who will assume the duties of factory manager and Carl J. Theken, former comptroller, who will become assistant secretary and assistant treasurer.

In announcing the purchase, President Howard U. Herrick said, "We want to emphasize to the Die Supply Company's many loyal customers that the only changes contemplated in the operations of the company are those which will improve, where possible, the high quality and quick availability of die supplies for which the company has become so well known to industrial firms throughout the midwest."

INCREASE PRODUCTION EFFICIENCY... with FINGER-TIP CONTROL

LOVEJOY variable SPEED PULLEYS

A turn of the hand is all that is required for instant speed adjustment on your machinery. Changes in production schedules, operator speed correction or specification variations are accomplished without loss of time or labor. Sizes from fractional to 8 h.p. Ratios from 3 to 1.

WRITE TODAY for fully illustrated catalog and engineering manual

LOVEJOY FLEXIBLE COUPLING CO.

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Also Mfrs. of Lovejoy Universal Joints and Lovejoy Flexible Couplings

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FASTER! SURER! SAFER! SEPARATIONS OF SHEET STEEL AND LAMINATIONS.

G. S. BLODGETT CO., Inc., Burlington Vt., manufacturers of baking and roasting ovens say "... many of our steel parts in fabrication are being handled more economically and with greater ease. We consider our BASCOS a good investment."

BASCO SEPARATORS

BASCO SEPARATORS reduce cost of handling, increase production, lessen injuries, save gloves, stop double feeding, lift polished or painted parts without scratching.

SEPARATES GREASY, ROUND, SQUARE NESTED OR ODD SHAPES

SHIPPED ON APPROVAL

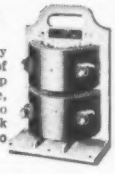
. . . if not completely satisfied, return to us — NO EXPLANATION NECESSARY

Send for the New Basco Catalog

Distributor Inquiries Invited.

PERMANENCE OF MAGNETISM GUARANTEED

FIVE STANDARD MODELS to simplify handling of sheet steel up to ¼" plate, stock width to 48", stock heights to 10½."

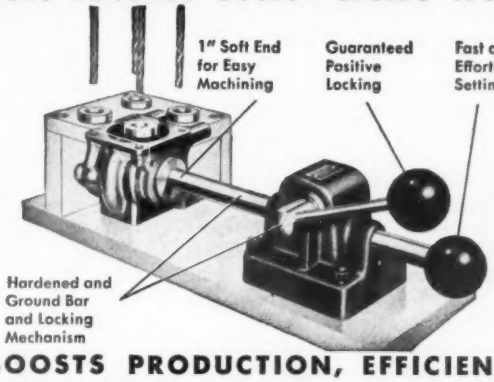


Basco Manufacturing Co. 25 Woodside St. Stamford, Conn.

CIRCLE INFORM-A-GRAM KEY NO. 151B

HEINRICH "GRIP-MASTER" FIXTURE LOCK

CUTS TOOLING COSTS—SPEEDS WORK


1" Soft End for Easy Machining
Guaranteed Positive Locking
Fast and Effortless Setting
Hardened and Ground Bar and Locking Mechanism

BOOSTS PRODUCTION, EFFICIENCY

Now—at the request of industry—we offer the new "Grip-Master" Screwless Fixture Lock, applicable for fixtures and jigs used in drilling, milling operations, etc. It incorporates the same high-quality locking mechanism proved by industrial use in the famous "Grip-Master" Screwless Drill Press Vise. Pays for itself quickly by increasing production, cutting tooling costs, etc. See your Dealer, or write for details.

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Be sure you have a complete Heinrich Tool Catalog in your files. Your copy will be sent free upon request.

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DRILL PRESS VISES • FIXTURE LOCKS • NIBBLERS PUNCHES • ROD CUTTERS

CIRCLE INFORM-A-GRAM KEY NO. 151C

Sold Thru Leading Supply Houses

GROBET CHATTERLESS COUNTERSINKS

They are terrifically popular because the six staggered cutting edges are scientifically designed to give a shearing cut and thus eliminate all chatter. Made in 12 sizes in all degrees; also supplied as sets in strong Kit-cases.

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Plants: New York, Chicago, Montreal

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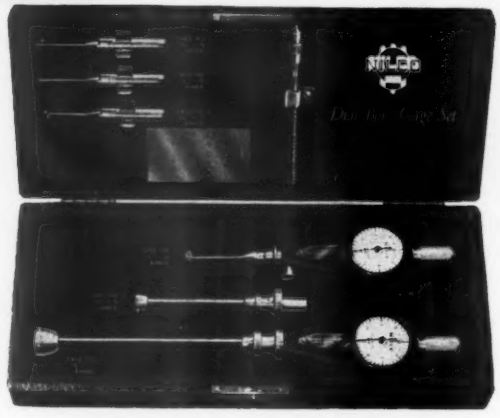
SAVE $250 on precision DIAL BORE GAGES



6-Gage Economy set range .090" — 1".

Save 25% by purchasing these beautifully designed, long lasting NILCO Dial Bore Gages in sets! They are interchangeable

Save on production costs! Operators using NILCO Dial Bore Gages see the condition of the holes and control the size right at the machine. Better parts and fewer rejects are the result.

NILSSON GAGE CO., INC.
Poughkeepsie, New York

CIRCLE INFORM-A-GRAM KEY NO. 152B

Automatic Loaders for Single Ram Broaching

The new Red Ring automatic loaders designed for use on single ram vertical surface broaching machines are particularly adapted to the handling of round parts on which flats, slots or ends are broached.

The loaders have magazine feed arrangements that work in conjunction with a hydraulic cylinder powered load and unload mechanism. The 1,000 psi hydraulic control cylinder is flange mounted at the rear of the loaders and is operated by an air booster. A standard air line source will operate the boosters.

Loader Operation

The loader at the bottom of the accompanying illustration positions two ⅞-in. dia., 6-in. long automotive automatic transmission control rods in front of a broach on a single ram vertical machine where two slots and one end are finished by the broaching process.

Parts are loaded on the magazine between side rails. With the vise jaws retracted, two rods drop into position, one above the other in the jaws. Then the jaws are pushed forward against a stop by the cylinder, and the air booster applies high clamping pressure.

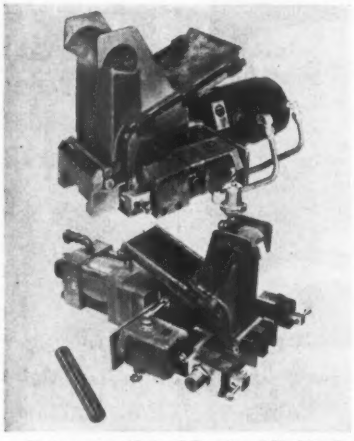


Photo courtesy National Broach and Machine Co.

There are two types of Red Ring automatic loaders for use with single ram broaching machines. A transmission control rod on which two slots and one end are broached in the lower automatic loader is shown at the lower left of the photograph.

The resulting pressure build-up in the hydraulic cylinder causes a sequence valve to initiate the broaching machine ram downstroke, broaching the two flats and one end on each part simultaneously. When the ram reaches the bottom of the stroke, the high clamping pressure is released and the ram returns.

Two unloading dogs on the top of the broach holder grip the two parts and carry them up out of the vise jaws. A curved chute at the top of the loader picks off the parts from the unloading dogs and they slide out on an angular chute into a container. When the finished work is lifted clear of the vise, the vise retracts to receive again from the feed.

Red Ring single ram broaching machine automatic loaders are made in a variety of sizes to meet specific application requirements, the majority of which are built around the basic design of the loader described here. The loaders are designed to operate in conjunction with individually designed broach holders.

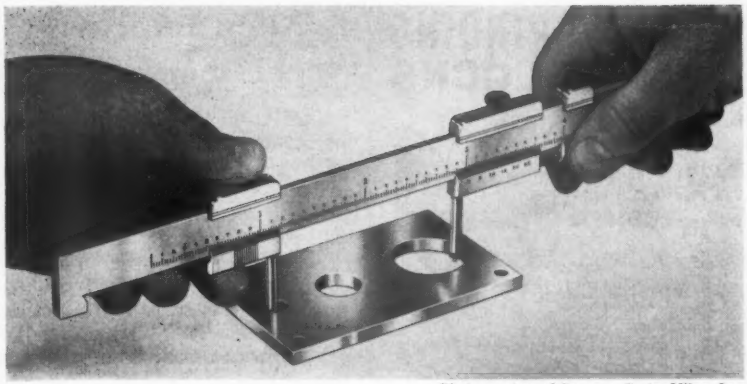


Photo courtesy of Sorensen Center-Mikes, Inc.

Direct Reading Measurement of Hole Center Distances

With the tool illustrated above, the dimension between hole centers can be measured and read directly on the vernier to an accuracy of .0005". Known as the Center-Mike, it has the usual arithmetic of such measurements already "built in" so that the user does not have to know the hole diameters and does not have to note any intermediate measurement or make any calculations.

The ingenious working of the Center-Mike is best explained by describing the two simple settings that result in a direct reading of the distance between two hole centers.

Referring to the illustration. the start is made by sliding the left-hand caliper leg clear to the left or zero position. Then the right hand slide positioned so that the two legs are calipering the distance between the closest points of the two holes. Then the right-hand slide is locked. Thus the right-hand slide has traveled along the scale a distance equal to the distance between the two holes.

Next, the left-hand slide is brought into contact with the right-hand slide and locked. Then, after unlocking the right-hand slide it is moved along the scale in order to do the job of calipering the distance between the farthest points of the two holes, after which it is again locked. (This second calipering is the one shown in the illustration.)

The completion of the second calipering, and locking of the right-hand slide, means that the right-hand slide has been traversed along the slide in two steps. The first step equaled the distance between the holes. The second step equaled the diameter of one hole, plus the distance between the holes, plus the diameter of the other hole. Therefore, the sum of the two steps (the second positioning of the right-hand slide) divided by two equals the distance between the hole centers.

The operation of dividing by two is automatically done upon reading the second position of the right-hand slide because the "inches" on the beam of the Center-Mike are each actually two inches. This is why, also, that the "stretched" vernier can be easily read to .0005".

The Center-Mike can be used equally easily and accurately for determining the distance between a hole center and edge of a workpiece. The procedure is the same as described above, using the workpiece edge and the near and far hole points, except that the radius of one caliper leg is subtracted from the dimension as read on the scale.

Center-Mikes are made in three sizes, capable of maximum center-to-center measurements of 4.4, 7.4 and 12.4 inches respectively.

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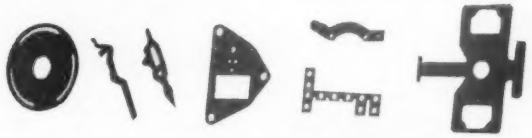

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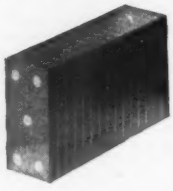

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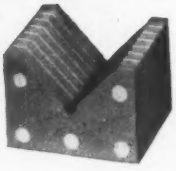

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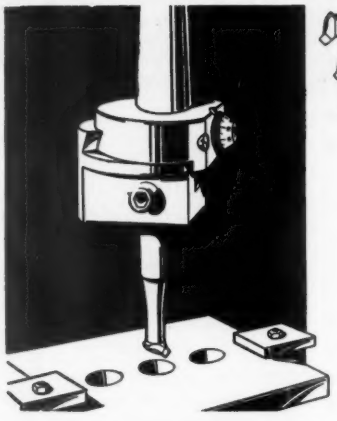

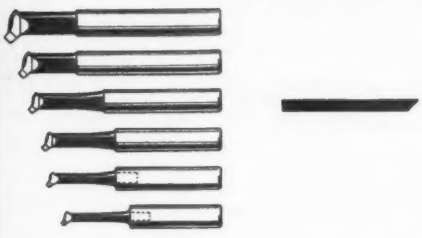

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Allen Improves Socket Screw Points

The Allen Manufacturing Company, originator of the Allen socket screw, announces two improved types of point, one applied to set screws and the other to cap screws.

A smaller cup point for set screws, Figure 1, called the Allenpoint, now in full production, will replace A. S. A. cup point set screws in the standard Allen line.

Fig. 1. Smaller Allenpoint cup gives set screws improved performance.

This new point was tested comparatively with standard cup point set screws and screws with angled and serrated points by the United States Testing Laboratory. According to the independent laboratory, the new Allenpoint demonstrated greater locking at all measured installation vs removal torque pressures, uniformly high shaft holding power in torque resistance tests, unequalled performance under vibration and more complete shaft contact pattern.

The Allenpoint set screw is available through Industrial Distributors, in Allenoy and stainless steel, with either NC or NF threads. The company's standard line of oval, flat, cone and dog point set screws will continue to be available as standard stock items.

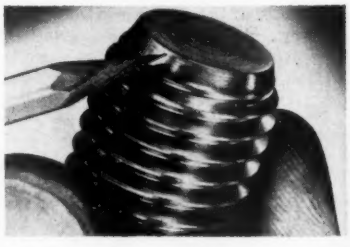


Fig. 2. Unthreaded leader point designed to make Allen cap screws easier starting.

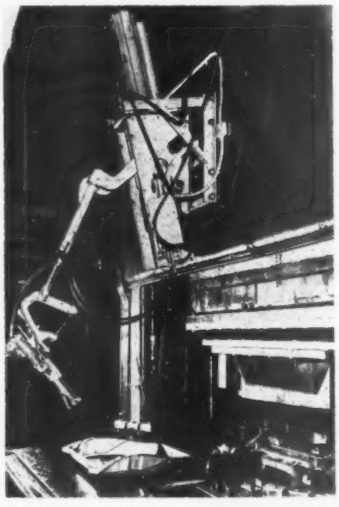
A new unthreaded leader point has been developed for Allen cap

screws, Figure 2, is designed to reduce substantially the cause of screw thread injury and damage to threaded holes. Improved line-up, particularly in inaccessible spots, and protection from damage resulting from dropping or knocking against other metal surfaces are claimed for the new leader point. It will be a standard Allen cap screw feature.

Large-Area Stampings Unloaded with Ease

Automatic unloading of large-area stampings is facilitated by a newly-designed attachment for Sahlin Iron Hands called a "Floating Mechanism". The unit enables the gripping jaw to lift parts in a die 20 inches vertically before swinging out.

Developed by Sahlin Engineering Company of Birmingham, Michigan, the mechanism consists of a C-shaped hinged assembly that allows the gripping jaw to pivot at the back. An air cylinder supplies the power for raising the jaw vertically. Standard Sahlin Iron Hand unloaders provide a normal 4" to 8" vertical travel before swinging out.



Floating mechanism (above gripping jaw) enables the Sahlin Iron Hand unloading machine to lift inner door panels 20" vertically before swinging out. The development allows press users to adopt automation methods with existing dies. The unit is one of several recently installed at Nash Motors, Milwaukee.

Several Sahlin Iron Hands equipped with the new "Floating Mechanism" have been installed at Nash Motors, Milwaukee, Wisconsin, for unloading inner door panels, hoods and roofs.

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Remote Control Speeds Handling

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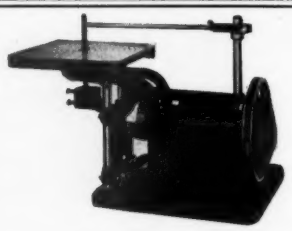
Photo courtesy Automatic Transportation Co.

Kling Brothers Acquire Pope Machine Co. Stock

Kling Brothers Engineering Works of Chicago, makers of steel fabricating machinery, announces it has purchased all capital stock of Pope Machine Co. Inc., Seattle, Washington. Pope, makers of plate bending rolls will be a subsidiary of Kling.

New officers of the Seattle firm are Arthur H. Heist, president, William C. Pope, and Carl W. Kling, vice presidents, Alfred G. Kling, secretary and treasurer, and L. W. Sistig, assistant secretary and general manager.



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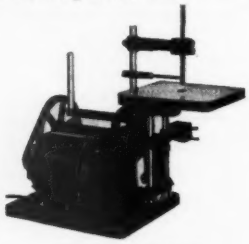

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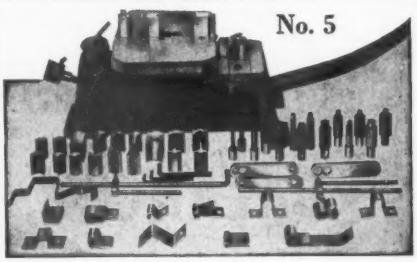

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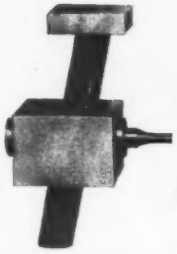

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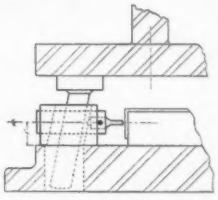

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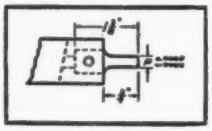

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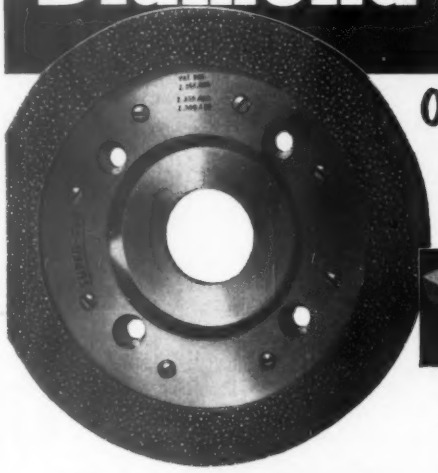

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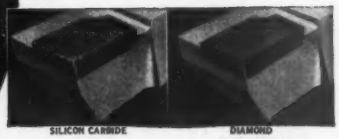

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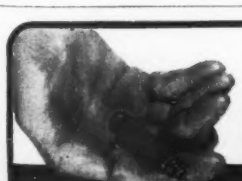

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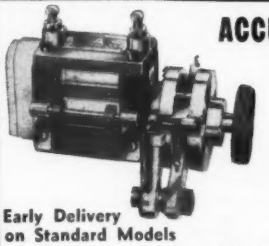

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CIRCLE INFORM-A-GRAM KEY NO. 158E

Tungsten Carbide Tooling Substantially Reduces Clutch Lug Milling Time

INCREASED CUTTER LIFE of 250 per cent coupled with a reduction in milling time of 75 per cent was recently obtained on clutch lugs at Ernest Holmes Co. of Chattanooga, Tenn., by a drastic changeover from conventional high-speed steel slotting mills to staggered-tooth tungsten carbide cutters. Their operation consists of making six passes (three per side of the part) to form three lugs on each side of a 4-inch diameter by 1¾-inch

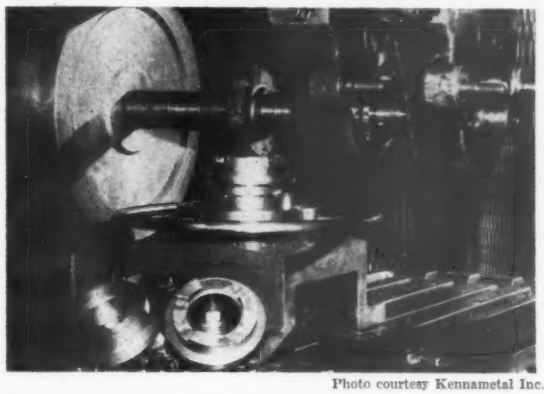

Photo courtesy Kennametal Inc.

Clutch lug milling time reduced 75% and cutter life extended two-and-one-half times by switching from conventional HSS slotting mill to a staggered-tooth cutter tipped with K2S carbide.

thick, SAE 4140 hot-rolled steel positive clutch as shown in the photograph. The machine which handles the work is a Cincinnati No. 3 having a 1½-inch arbor.

Their previously-used cutter was of 6-inch diameter having 28 cutting teeth. It was run at 3⅜-inch feed rate, 80 SFM, taking a 5/16-inch depth of cut. Under these operating conditions milling time per clutch lug was 17 minutes while cutter life was only 52 piece per grind.

Output Boosted Over 300 per cent—Now with their 5-inch diameter cutter having 8 brazed-in teeth of a K2S carbine, the job is handled at the same depth of cut but at 450 RPM, with a 20-inch feed rate and 588 SFM, production time is only 4.1 minutes per piece with cutter life averaging over 150 pieces per grind. Chipload is 0.0055-inch.

This new tool employs standard style K-1400 tungsten carbide blanks brazed into the cutter body at a 15-degree negative radial rake and 25-degree negative axial rake, so its staggered teeth project beyond the unit's body to produce a 1-inch wide cut.

A flywheel of 14½-inch diameter is used on the arbor to assure smooth power flow to the carbide tipped cutter whose longer life and ability to operate at higher speeds provide a substantial production increase on this particular job.

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ROTARY, INDEX, MILLING TABLE
The only Table Having ROTARY FEED Combined With DUAL CROSS FEEDS!
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Now Only $54.50
Turns Your DRILL PRESS Into A VERTICAL MILLER
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CIRCLE INFORM-A-GRAM KEY NO. 159C

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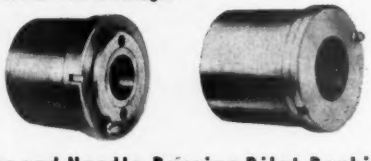
Heavy duty boring mill operation utilizing Jergens absolute seal Pilot Bearing Bushing to increase precision, depth of cut and tool life.

Only Jergens Absolutely Seals Out Coolants and Grit

As a result of ingenious design and precision manufacture, Jergens Pilot Bearing Bushings provide for the first time in bearing applications an absolute seal against coolants and fine powdered abrasive grit and dust entering the bearing cavity. Jergens Bushings make possible increased precision in piloting applications with greater depth of cut and eliminate costly tool failures and expensive down time.

The world's largest production plants are today making Jergens Pilot Bearing Bushings an absolute must wherever tool holders require support to increase accuracy and stock removal or to decrease tool breakage.



Roller and Needle Bearing Pilot Bushings Performance Features

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- Bearings can be dissembled without removing housing
- Cartridge-type bearing holder provides greater accuracy
- Protects against thrust loads as well as radial
- Tapered bearings can be adjusted to compensate for wear
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Brown & Sharpe Wins Award for Hiring Handicapped

Henry D. Sharpe, Jr. (left), president of the Brown & Sharpe Manufacturing Company, Providence, R. I., received a certificate of Appreciation from the American Legion officials in recognition of the company's outstanding record for employment of physically handicapped veterans. During the past year, Brown & Sharpe has hired 1,000 veterans, 400 of whom have had some degree of physical handicap. In presenting the citation, Robert F. Bergeon (right), department commander, stated that the company "helped raise the morale of these persons by giving them a chance to prove that their physical handicaps are not job handicaps". Assisting at the presentation ceremony is John F. Radikin, department employment chairman.

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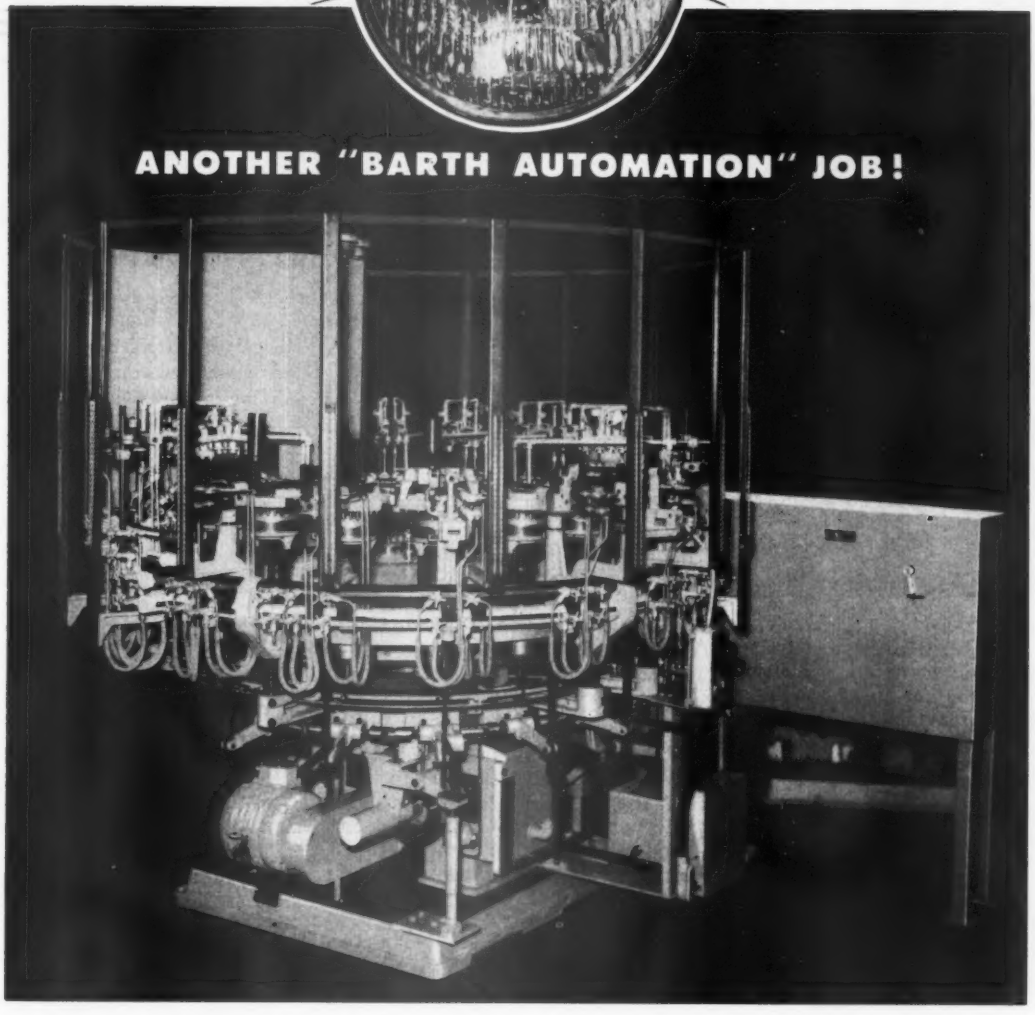

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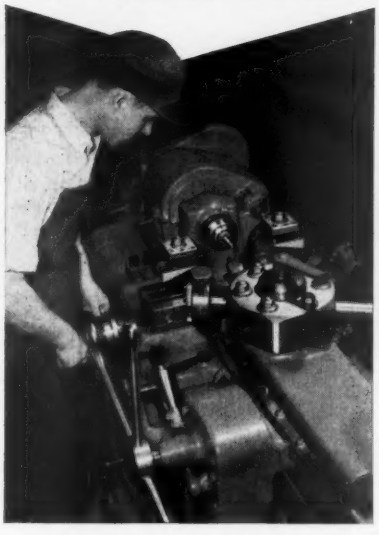
2-H TURRET LATHES



South Bend 2-H Turret Lathes have the stamina for exacting close-tolerance work, rigidity for producing fine finishes and ample power for smooth performance. Gear box provides 48 power feeds each for turret ram, universal carriage and double tool cross slide. Such a wide selection of feeds insures all-job range. Where can you find a better turret lathe value? Write for information on this fine machine.

SPECIFICATIONS

Spindle Hole—1⅜". **Collet Capacity**—1". **Swing**—16¼". **Spindle Speeds**—20 to 945 r.p.m. **Turret Feed**—5⅞". **Dia. Turret Holes**—1½". **Thread Range**—4 to 224 per in. **Motor (2-speed)**—2, 1 h.p.

▶ **$3190** Illustrated, less electrical equipment, f.o.b. factory. Time payment terms: 10% down, the balance in 12 or 18 months.

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SOUTH BEND LATHES

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Stainless Steel Pioneer Retires . . .

Leaves Firth Sterling after 39-Year Period

L. Gerald Firth, the man who introduced stainless steel to America, and internationally known pioneer and authority on specialty steels and sintered carbides, has retired as vice president and director of research for Firth Sterling Inc. of Pittsburgh, Pa. after 39 years of service with the company.

Mr. Firth witnessed the first pouring of a stainless steel ingot at Thomas Firth & Sons in Sheffield, England in 1913, and brought the formula and process of Harry Brearley's invention to Firth Sterling in McKeesport, Pa., early the following year. His theory, which was tested and proved correct, was that by sufficiently lowering the carbon content of the metal, a grade of stainless steel could be obtained which would be stainless without hardening. This was the genesis of the well-known "stainless iron" now known as type 410.

L. Gerald Firth

He made many contributions to the tool and die steel industry and was directly responsible for the development of universally used Circle C High Speed Steel. During the same period, Mr. Firth was instrumental in the development of Cromovan, a well-known and widely used die steel.

Born in England in 1886, Mr. Firth attended Uppingham School and Cambridge University. In 1910 he joined Thos. Firth & Sons in Sheffield, England, where he was employed in their Tinsley Tool Steel Plant. In 1918 he permanently settled in Pittsburgh, and became works manager of Firth Sterling. From 1933 to 1947 Mr. Firth served as president and general manager of the company.

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RELIABLE METAL CUTTING TOOLS

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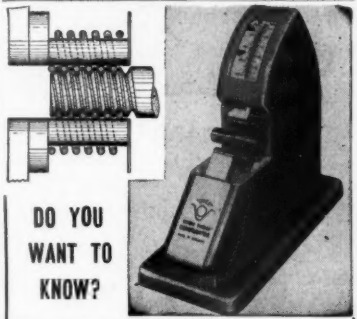

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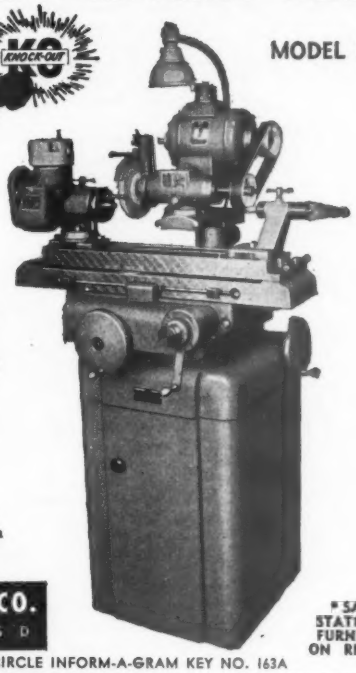

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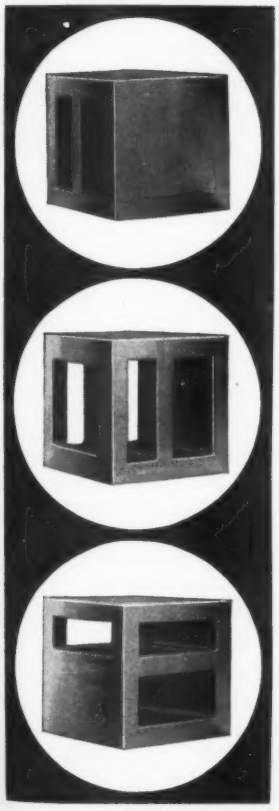

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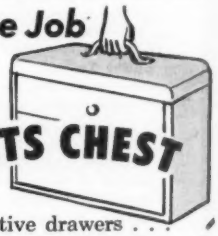

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You will realize the difference a collet can make in the quality of your production once you try Benco. Regardless of the make of machine or the type of material used, you can expect more perfect results on any operation with Benco Collets. They cost no more than ordinary collets.

For constantly better production ...Get Benco...10 ways better!

BENCO also makes

- Master Pushers and Pads
- Pushers and Feed Fingers
- Master Collets and Pads
- Collet Sleeves and Chuck Nuts for B&S Machines
- Carbide Faced Stock Stops for B&S Machines
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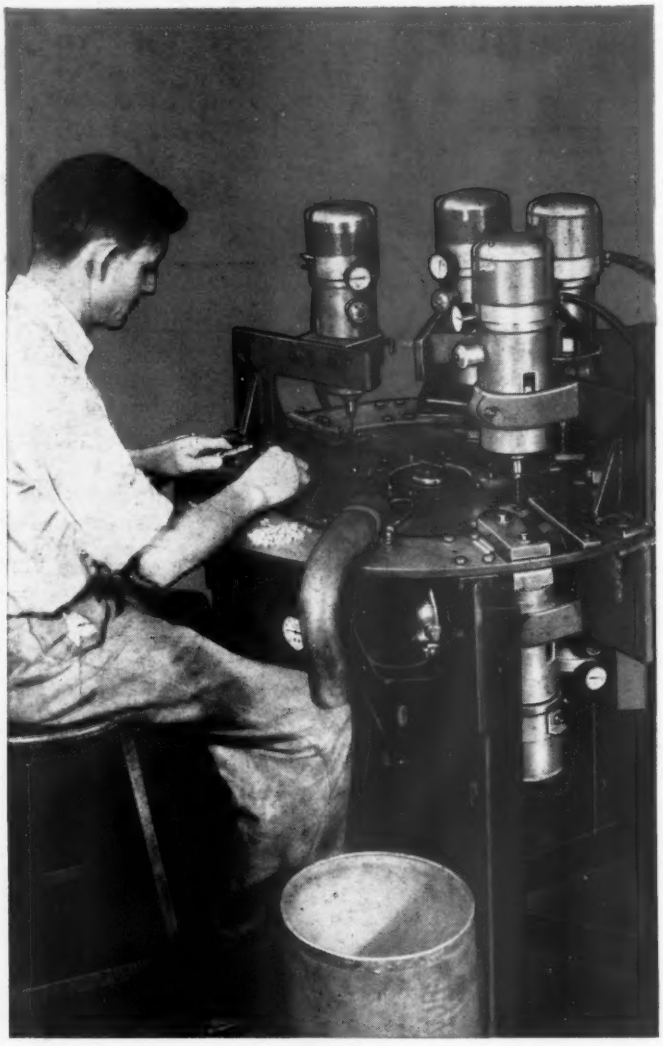
Why buy expensive tooling

...when Dumore Drill Heads will mass produce small holes...at a fraction of the cost!



NOW, with Dumore Automatic Drill Heads, you can put small hole drilling on a mass production basis without making a major investment!

Low-cost Dumore Automatic Heads mount in any position . . . are easily set up to handle practically every small hole drilling operation. They make it simple to drill multiple holes in a single workpiece in only one operation . . . are equally efficient as components of multiple station machines.

Why? Because these compact, 17½-lb. precision tools are self-contained . . . require no expensive air or hydraulic lines...have built-in automatic controls.

However, outstanding productivity and flexibility are not the only advantages Dumore Drill Heads offer. They also give you substantial benefits that effect conservation of skilled labor . . . big reductions in drill breakage. So get all the facts now. Contact your Industrial Distributor or write:

◄ This setup consists of six Dumores — mounted four above and two below an indexing table. It solved the problem of production drilling and chamfering two holes (.038" and .076") in a tiny (.109") brass part.

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DUMORE PRECISION TOOLS

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